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JULY, 1944

# *The* **TOOL ENGINEER**

*Official Publication of  
American Society of Tool Engineers*

When your  
**DIE PROBLEMS** include:

**CLOSE TOLERANCES  
INTRICATE SHAPES**

your best Steel  
selection is

# **CROCAR**

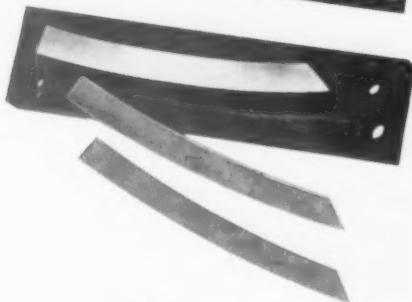
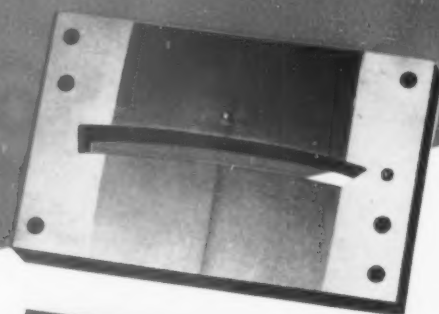
Blanking stainless steel strip to aviation specifications, holding tolerance within close limits over long continuous runs, is one of the many die problems solved every day by the selection of CROCAR—your logical steel for tough die jobs.



## **Vanadium-Alloys**

**STEEL COMPANY**

**LATROBE, PA.**



**PUBLISHED BY THE BRAMSON PUBLISHING COMPANY**

20 Cleopas Street  
Liverpool 8  
England  
3 Jan. 1944

The P&W Co.

Dear Sirs:

Will you please send to me, for reference purposes, catalogues giving detailed particulars of all fine precision engineering tools of your manufacture.

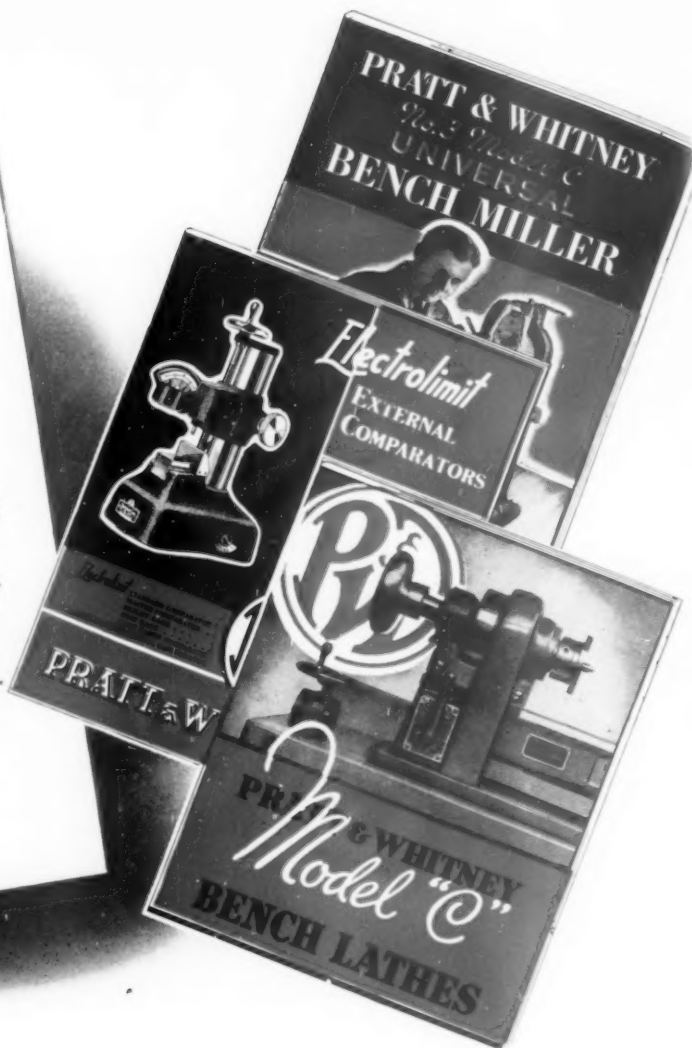
I am especially interested in adaptable machine tools, including small lathes equipped for milling, dividing, precision grinding, etc., threading tools, chasers, dies and taps, miniature die making equipment, cutters, measuring machines and gauges.

After the war, when I am in the Eastern United States, I should like very much to visit your plant, because during the past few years I have repeatedly noticed how tools marked "P&W Co." continue to give accurate reliable service long after many others have passed away.

Yours faithfully

*David J. Cook*

David J. Cook



## "They're in the mail, Mr. Cook"

Needless to say, we lost no time in forwarding all necessary information to our appreciative customer across the Atlantic.

This message of commendation from overseas illustrates, as nothing else can, the fulfillment of a promise — the promise of fine tool-making.

Now, as never before in history, precision tools are being given a chance to prove their worth — or drop out. In Britain, for even more years than here at home, precision tools have been taking the terrific, high-pressure beating of war-time mass production. Only phenomenal toughness and complete accuracy can stand up under this never-ending grind.

As Mr. Cook points out, long after other tools have reached the scrap-pile, *P&W tools can take it.*



# PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT





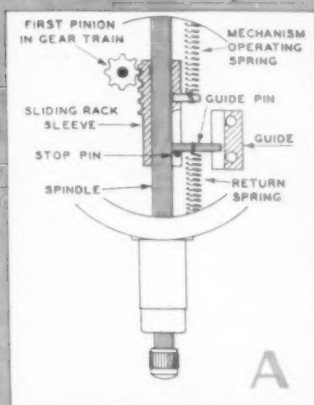
**STANDARD**

# SHOCKPROOF *Dial Indicators*

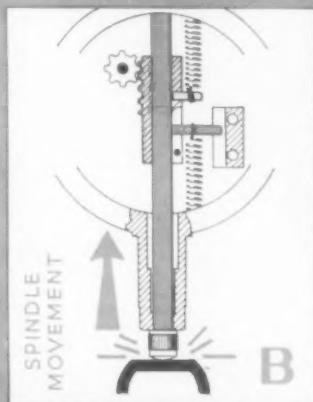
**Here's How The SHOCKPROOF Action  
Protects the Precision Mechanism**



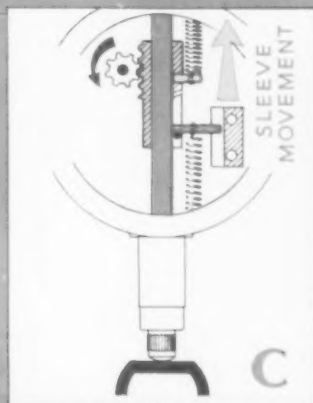
**22 MILLION BLOWS,**  
struck deliberately on a stock gage,  
failed to damage gear teeth, bear-  
ings or spindle, or impair the instru-  
ment's accuracy.



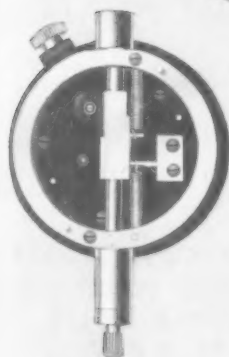
**A**



**B**



**C**



Rear view of SHOCKPROOF  
Dial Indicator, cover re-  
moved, showing "Free Wheel-  
ing" mechanism.

- A — Rest Position**
- B — Sudden blow or contact by work piece raises spindle.**  
For an instant guide pin moves away from contact with  
stop pin. This allows mechanism operating spring to  
raise the rack sleeve which is slidable on the spindle.
- C — Stop pin and guide pin resume contact after the mech-  
anism operating spring has actuated the gearing. Rela-  
tive position of spindle and rack sleeve is restored.**

In actual use only the more sudden shocks against the  
contact point jar the spindle ahead of the rack sleeve.  
For normally applied contacts the sleeve and spindle  
move together as a unit. In any case the force on the  
mechanism is never any greater than the pull of the  
spring.

WRITE FOR COMPLETE CATALOG



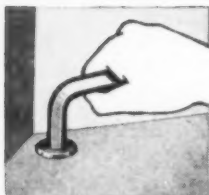
**STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.**

# HOLO-KROME *fibro forged* SOCKET SCREWS



*Completely  
Cold Forged*

The Method (Patented, owned, controlled and exclusively used by Holo-Krome) is one of the major differences between a Socket Screw and a Holo-Krome FIBRO FORGED Socket Screw. It's Completely Cold Forged! Thousands of users attest to the many advantages of specifying "HOLO-KROME". Yes, It's the Method.



◀ INTERNAL WRENCHING FEATURE  
QUICK & POSITIVE TIGHTENING

THE **BETTER** FASTENING METHOD



**PRECISION MADE  
TO EXACTING STANDARDS**

SOCKET HEAD CAP SCREWS... SOCKET  
SET SCREWS . . . SOCKET PIPE PLUGS  
SOCKET HEAD STRIPPER BOLTS...  
SOCKET SCREW KEYS & KEY SETS

**GUARANTEED UNFAILING PERFORMANCE**

*The* **HOLO-KROME  
SCREW CORPORATION**

*Main Offices & Plant*

**HARTFORD 10, CONN., U. S. A.**

# THE TOOL ENGINEER

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

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## Publisher's Letter

LAST month I wrote you from Los Angeles—this time we're in Hartford. Between times, we visited many plants from coast to coast.

In travelling up and down production's main street we came to one pungent realization ... that mass manufacturing has received a stimulus as a result of the war that is beyond the ken of most of us. We have been so engrossed in our own problems that we have failed to discern what has happened on the production front.

The west coast has witnessed the birth of mass production industries that have amazed the nation. In New England, we sense a renaissance of production techniques that may lead the way to a re-vitalized tool and machinery industry which will benefit all mass manufacturing. Precision now seems commonplace

in all sections of the country—war product tolerances resulting in higher standards of quality and finish.

To return to pre-war manufacturing standards would be retrogression, many production men have told us. Greater precision with enhanced product wearability at lower manufacturing cost seems to be the goal of alert production engineers.

"We'll streamline our production for less cost per piece and get a better product that can be sold at a price people can afford to pay" is the thinking of men on both coasts.

A hint of the "streamlining" that is coming was revealed in our PRODUCTION Round-Table here in Hartford. Thinking here is along lines anything but strictly conservative, such as our "hard-shelled" Yankee friends are famous for. They envision new plant designs and layouts with central "coolant systems" which will funnel all liquids used in processing to a central "well" with cleansing and sterilization of these

liquids before recirculating to machines (see page 104).

Scientific illumination with scientific painting of work areas on machinery for greater efficiency and safety of workers are factors New Englanders visualize in the ultra modern plant.

To point up some definite conclusions that can be drawn today, we have been asking a number of questions as we travel about the country. These are published for the first time this month in our poll of the metal working industry (see page 106).

You may not agree with the preponderant answer, but you'll have your chance to "vote" via the prepaid ballot we're sending you through the mail. Check it and return it promptly, won't you?

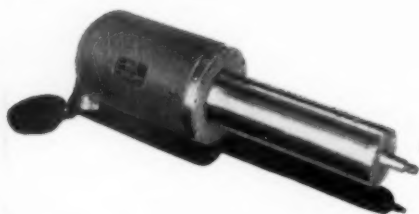
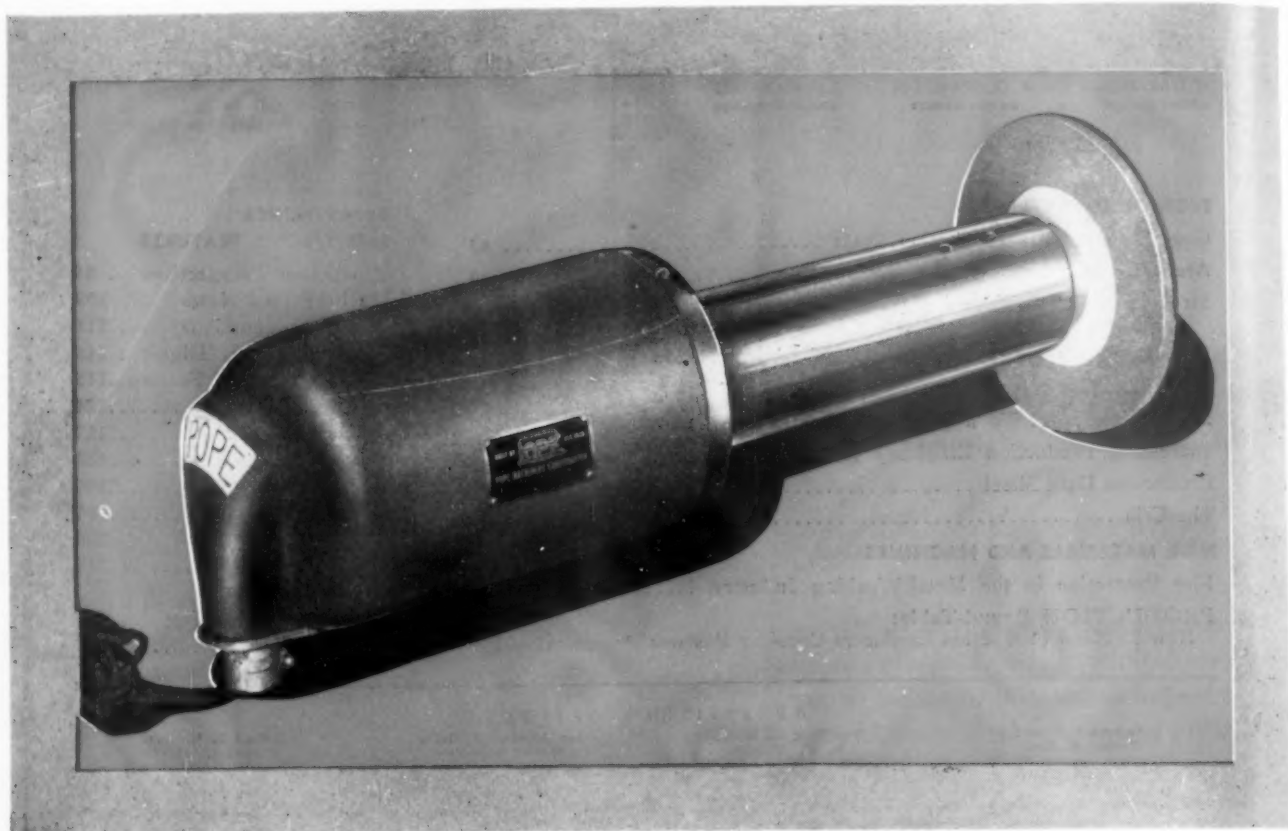
Cordially yours,

*Roy T. Bramson*

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# THIS *New* POPE SURFACE GRINDER SPINDLE



This POPE Motorized Spindle with the new G-E Motor Sealed In and SKF Roller Bearings delivers full 1 H. P. at the wheel

It is designed specially for 6" x 18" surface grinders. It also operates horizontally, vertically or at any angle on boring mills, planers, milling machines and other machine tools for special work.

## Has a G-E Motor *Sealed In*

POPE engineers and GENERAL ELECTRIC engineers, working in collaboration, have produced a new motorized grinding spindle employing a motor designed specifically for operation in a *sealed housing*. Think what this means in terms of operating efficiency and economy! These Spindles always run at their best, because dust and dirt never get a chance to collect on a fan or in cooling passages causing unbalance and loss of cooling efficiency. POPE Spindles never require operator attention for lubrication or adjustment.

POPE Spindles with their fine craftsmanship, SKF Super-Precision Double-Row Roller bearings and the new *Sealed-in* construction with G-E Motor produce finer finishes than ever. At the same time they have the power, the bearing capacity and the rigidity for rapid removal of metal when required.

You have only to install one of these new completely *sealed* units to appreciate what an improvement and what savings it makes. Try it, and see for yourself!

For complete information, get in touch with



REG. U. S. PAT. OFF

### POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS  
BUILDERS OF PRECISION SPINDLES

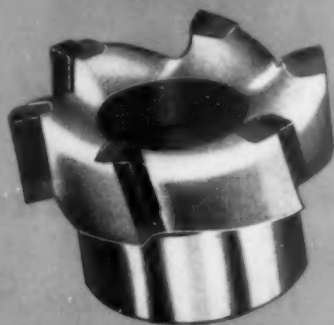


*An Open Letter and Invitation to*  
**Tool and Die Makers**  
*Who Have Shop Problems*

- Several years ago Kearney & Trecker began helping tool and die makers with their shop problems whenever they'd write in asking as to the best method of producing a particular tool or die. These requests for help included the making of plastic molds — forging, die casting, stamping, and drawing dies. In fact, they covered the whole tool and die field.
- In many cases our Model D Rotary Head Miller would handle the job to perfection — in other instances, after looking at the blueprints, we'd recommend some other method of producing the tool or die that was troubling them.
- Because of the extreme pressure which all of us were working under at that time, we didn't publicize the fact that such service was available. BUT... now we have set up facilities in our Tool and Die Department which will enable us to give you *prompt* advice without obligation, as to the fastest, cheapest way to do the job.
- If our Model D Rotary Head Miller is, in our judgment, the best bet for producing it — we'll tell you. In fact, we'll even make the job for you at a *very nominal cost* here in our own Tool and Die Department. What's more, we'd welcome having one of your men come to the plant to watch us make it.
- If, on the other hand, we feel that there's a better method of producing the tool or die — we'll return your blueprints with our recommendations. Fair enough?

*If you're interested — write Tool and Die Division,  
Kearney & Trecker Products Corp., Milwaukee 14, Wis.*

**Kearney & Trecker**  
**Products**  
CORPORATION



# HERE'S WHAT WE MEAN BY *SUPER* Performance!

When we say that with Super Carbide-Tipped Milling Cutters you can get faster cutting, cleaner cutting, finer finishes, greater accuracy and longer cutter life, we speak from the records . . . actual performance records of Super Milling Cutters in our files in Detroit. Here are some examples:

1. On one straddle milling job in 4140 SAE steel, 40-43 Rockwell Hardness, the HSS cutters were operated at a surface speed of 50 FPM. With Super Carbide Tipped cutters the surface speed was stepped up to 300 FPM. On this same job, the table feed was increased from  $\frac{7}{8}$ " per minute to  $7\frac{1}{2}$ " per minute. Other economies resulted through an increase from 90 pieces per grind to 216 pieces per grind. And in addition, with the Super Milling Cutters the job was run dry and the floor to floor time per piece was reduced from 30 minutes to 10 minutes.

2. On an end milling job on a steel forging a HSS cutter was operating at 80 RPM with a table feed of  $3\frac{5}{8}$ " per minute. When a Super Carbide-Tipped Shell End Mill was used, the RPMs were stepped up to 415 and the table feed increased to  $12\frac{1}{8}$ ". In addition the Super Cutter produced 90 pieces per grind as compared with 60 with the HSS cutter.

Why not try Super Carbide-Tipped Milling Cutters TODAY . . . and see for yourself what we mean by SUPER PERFORMANCE?

HAVE YOU RECEIVED  
THIS BOOK?

If not, write for your free copy TODAY. It illustrates and describes the complete line of Super Carbide-Tipped Tools.



## SUPER TOOL COMPANY

*Carbide Tipped Tools*

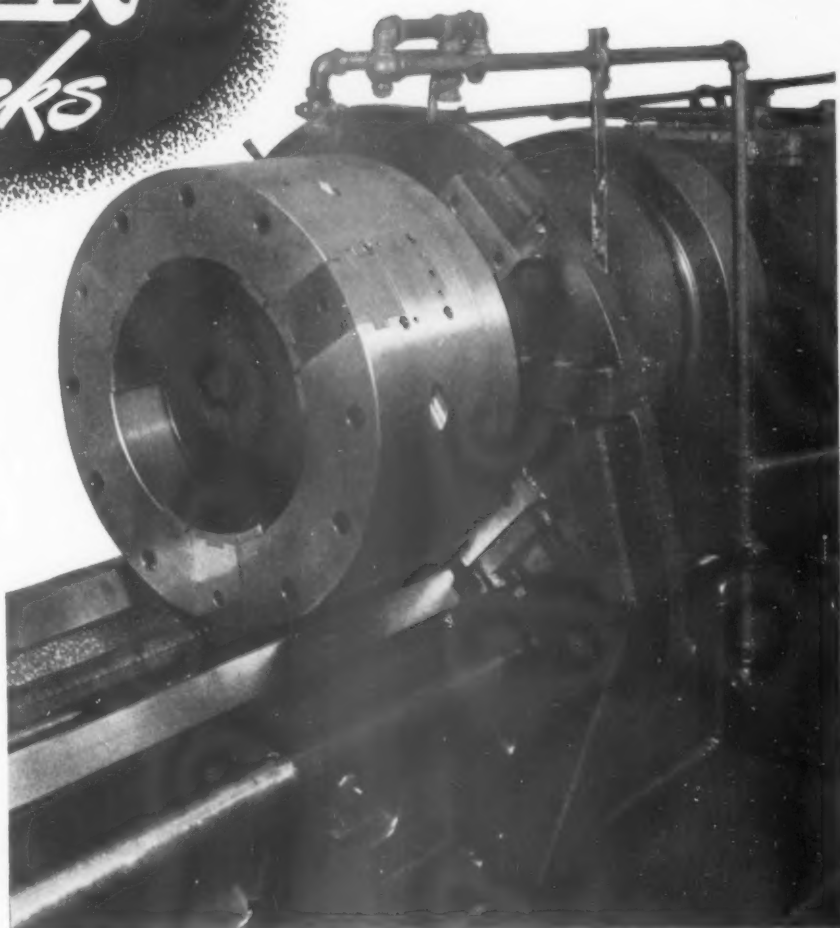
21650 Hoover Rd., Detroit 13, Mich. 4105 San Fernando Rd., Glendale 4, Cal.

# **"LOGAN"** *Chucks*

**For Positive, Permanent  
Chucking Accuracy**

The machining of 16-inch projectiles for our big naval and coast defense guns requires maximum rigidity and positive chucking accuracy. This heavy-duty Warner & Swasey turret lathe is equipped with a "LOGAN" 27-inch, 3-jaw Chuck to turn out shells that meet exacting navy specifications.

Note the gripping pads on the inside of the jaws, and the specially hardened wear strips. Also the mounting arrangement on the special long adapter, supported by steady rest.



## **HOW "LOGAN" ENGINEERS BUILD EXTRA SERVICE AND ACCURACY INTO EVERY "LOGAN" CHUCK**

### *Other*

#### **"LOGAN" PRODUCTS used on this Lathe:**

- "LOGAN" POWER UNIT
- "LOGAN" ROTATING TYPE  
HYDRAULIC CYLINDER
- "LOGAN" HYDRAULIC  
CONTROL VALVE
- "LOGAN" PRESSURE  
REGULATING VALVE

"LOGAN" Chuck bodies are one-piece electric steel castings, cored for light weight and correct balance, and radially reinforced for extra rigidity. Special heat treated steels are used in all working parts subject to operating stresses. Jaw levers are chrome nickel steel, drop forged and heat treated. All lever pins are nickel steel alloy, hardened and ground. Alemite lubrication of all working parts insures lasting accuracy and efficient operation through year after year of heavy-duty service.



**LOGANSPORT MACHINE CO., INC.**

902 Payson Road, Logansport, Indiana

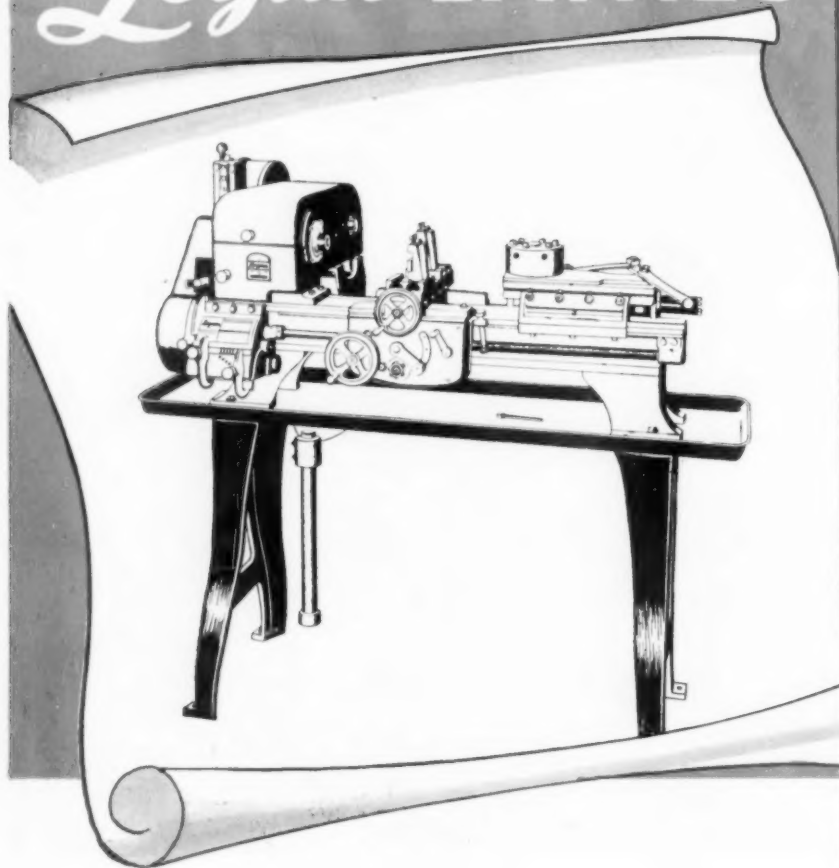
"LOGAN" manufactures a complete line of air and hydraulic operated Chucks, in two, three and four jaw models, in Universal and Combination types, Compensating Chucks, Finger Chucks, "Two-in-One" Chucks, Parallel Grip Collet Chucks, Indexing Jaw Types, and Drill Press Chucking devices.

"LOGAN" engineers will be glad to make specific recommendations on your chucking problems. Send us your specifications. The "LOGAN" Chuck Catalog (No. 70—Sec. 1) will be sent on request.

## **"LOGAN" Air and Hydraulic Equipment**

**CHUCKS \* CYLINDERS \* VALVES \* PRESSES \* SURE FLOW COOLANT PUMPS**

# Logan ACCESSORIES widen THE USE OF *Logan* LATHES



The tooling of Logan Lathes is just as important in obtaining maximum results as having an efficient machine. Logan Accessories are specially constructed with many patented improvements. They are built to the same standards maintained in manufacturing Logan Lathes. When used with Logan Lathes, accuracy is maintained, costs are lowered and output is increased. The various chucking accessories shown here are typical of a wide variety of other accessories that are available. To assure maximum efficiency from a Logan Lathe, ask your dealer or write for the latest Accessory Catalog.



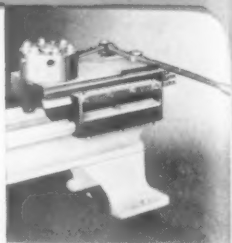
**LOGAN ENGINEERING CO.**

CHICAGO 30, ILLINOIS

*A Name To Remember When You Think of Lathes*

## LA 40-51 TURRET ASSEMBLY

Six position, self-indexing. Fits bed of any Logan Lathe.



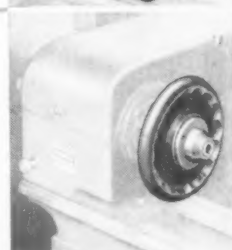
## No. AC 210 PRODUCTION COLLET ATTACHMENT

Quick acting, lever type collet closer operates while lathe spindle is in motion. For Push type collets up to  $\frac{3}{8}$ "



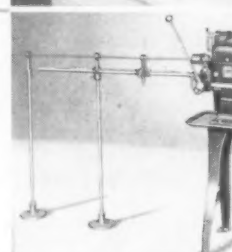
## No. AC 201 SPEED COLLET CHUCK

Fits any lathe with  $1\frac{1}{2}$ " x 8 thread spindle nose. Minimum overhang assures accuracy. For Push type collets up to  $\frac{3}{8}$ ".



## LA 32-34 BAR FEED

For Logan Hand Screw Machines. Uses Push type collets up to  $\frac{3}{8}$ " capacity.



## No. AC 105 and AC 166 PRODUCTION COLLET ATTACHMENT

Quickly attached to Logan Lathes. Operates while spindle is in motion. For Draw-in Collets up to  $\frac{1}{2}$ " capacity.



## No. AC 150 and AC 151 DRAW-IN COLLET CHUCK ATTACHMENT

Accurately chucks work between  $\frac{1}{16}$ " and  $\frac{1}{2}$ " capacity.

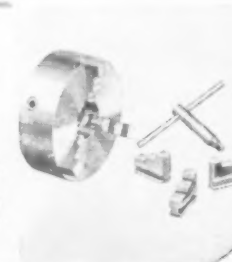


## No. 430 3-JAW, 5-INCH UNIVERSAL CHUCK

also

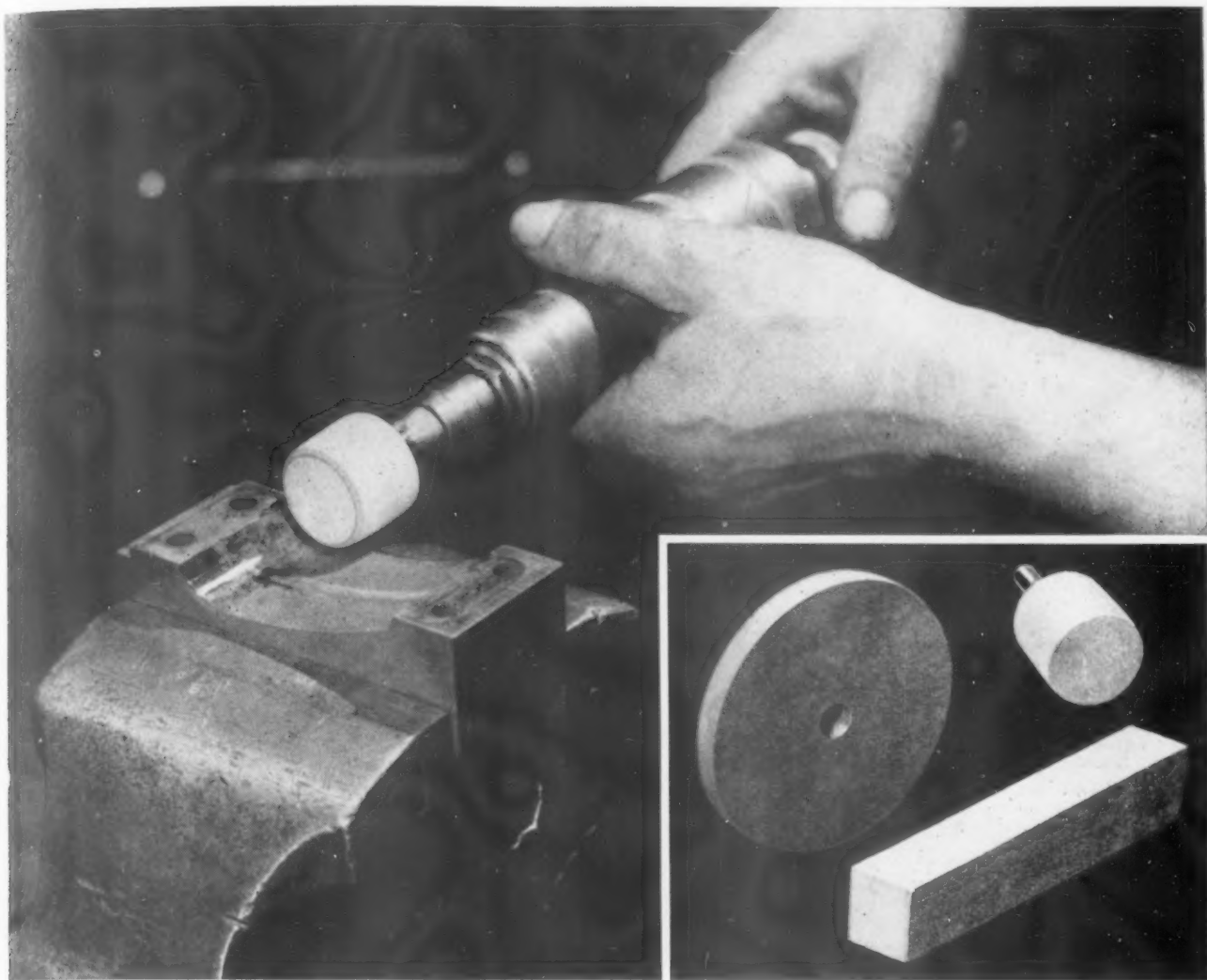
## No. 444 5-INCH INDEPENDENT CHUCK

Need no separate back plates. For  $1\frac{1}{2}$ " x 8 thread spindles.




THE TOOL ENGINEER





## Now a complete line "MX" WHEELS, MOUNTED WHEELS AND STICKS

 On a great many jobs which call for finishing and polishing there are always many out-of-the-way places—grooves, curves, angles and flat surfaces not readily accessible. To reach such places the "MX" Mounted Wheels, used on portable type machines, are proving to be the solution of this sometimes vexing problem.

"MX" Mounted Wheels have the same finishing and polishing action and the same characteristics as the straight "MX" Wheels. "MX" Wheels, both straight and mounted, are being used on such typical jobs as polishing out tool marks and scratches, cleaning out the channels of connecting rods, polishing and finishing the

hard-to-get-at parts. For burring and polishing any complicated metal shapes, parts and castings. For finishing flutes between the cutting edges of broachers and reamers. For breaking down corners on miscellaneous parts.

NOTE: "MX" Mounted Wheels are made only in the straight shapes but they can be readily shaped or formed by the user to meet his finishing or polishing conditions. It is a simple matter to point, groove or round the wheels using a fine grit Carborundum Brand Silicon Carbide Stick as a dressing tool.

"MX" Sticks are particularly useful for breaking down edges and finishing work that can be turned in a lathe. They are

also used with success for hand finishing molds and other such small, irregular surfaces.

"MX" Tools can save you time and improve the finish of your product. Send for "MX" Booklet which shows typical, successful, time-saving applications.

The Carborundum Company, Niagara Falls, N. Y.



**CARBORUNDUM**  
TRADE MARK  
ABRASIVE PRODUCTS

**"MX" Products by CARBORUNDUM**  
TRADE MARK

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids  
(Carborundum and "MX" are registered trade marks of and indicate manufacture by The Carborundum Company)

JULY, 1944

# a New VERTICAL HYDROHONER

## A High Production Vertical Type Hydrohoner

Diameter of Work . . .  $\frac{1}{4}$ " to 2".

Spline Driven Head Reciprocating Stroke  
. . . 15"—30"—40" (standard).

Spindle Oscillating Stroke . . . 0 to 1"  
maximum.

Centralized Hydraulic Operating Control. Panel provides easy operation—fast production. Hydraulic tool expansion assures uniform pressure and cutting rates for fast precision work.

Other features are—hydraulic timer—full ventilated hydraulic oil tank of 60-gallon capacity mounted in base.

Also available with 3-speed transmission, rising screw table, electric timer, special coolant filter, and special coolant refrigeration.

Available for normal prompt delivery.



## Micromatic HONE CORPORATION

DETROIT 4, MICHIGAN



**TANTUNG** is a non-ferrous cast alloy that operates at highest efficiency between 100 and 200 surface feet per minute.

**CUTS** rolled, forged or cast steel, annealed or heat treated, cast iron, aluminum, brass, copper, bronze and any material that can be machined.

**OPERATES** at greater speeds, heavier cuts, heavier feeds than high-speed steel tools.

**PRODUCES** more pieces per grind and insures better finish than high-speed steel.

Tantung has an exceptionally high transverse rupture strength—is tough and shock resistant. It is the high red hardness of Tantung that enables it to work so efficiently under heavier loads. It is self-lubricating and due to its keen, durable cutting edge “cratering” or “chip wear” is reduced to a minimum. Detailed information regarding the use of Tantung is fully covered in the Tantung Catalog. Write for your copy today.

**VASCOLOY**  **RAMET** CORPORATION

**CARBIDE TOOLS AND TANTUNG CAST ALLOY CUTTING TOOLS**

**NORTH CHICAGO, ILLINOIS**  
**SALES AND SERVICE IN PRINCIPAL CITIES**

**A New Base  
With a Coolant Pump  
Improves the Accuracy,  
Speed, and Finish  
of Jobs Honed on  
the **SUNNEN**  
**PRECISION HONING**  
**MACHINE****

**M**any internal honing and finishing jobs can be more efficiently handled on the Sunnen Precision Honing Machine with a stream of honing fluid flowing over the work.

For that reason, a new base and pump assembly is furnished with the machine. The new base is also available to present owners of the honing unit. The pumping unit provides a constant flow of honing fluid that acts as a coolant, carries away cuttings, and keeps the abrasive stone in sharp cutting condition. Accuracy is greater, finish is better, and speed is increased.

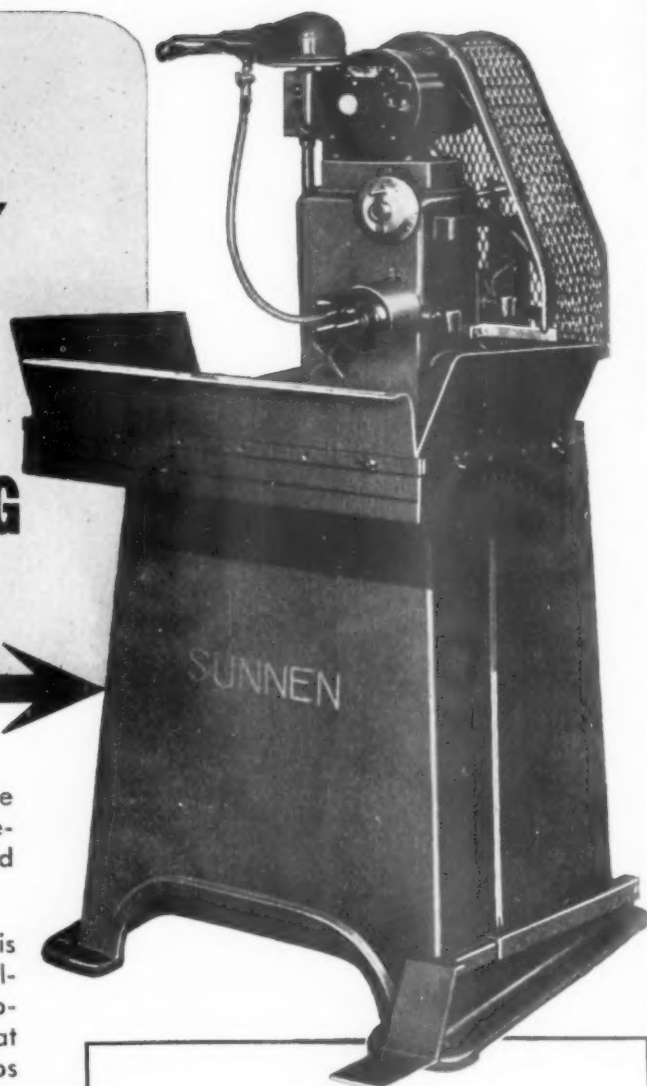
Other refinements include a machine light for inspecting the finish and gaging of the finished parts.

On the Sunnen Precision Honing Machine, straight, round holes are produced within .0001" of absolute accuracy. Production jobs in hardened steel have been held to a tolerance of .000025". A super-smooth finish of from 2 to 3 micro-inches provides a better working surface so that parts last longer on the job.

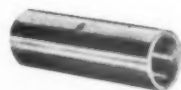


The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Get complete information on how all these advantages can be put to work in your plant on your internal finishing jobs. A Sunnen engineer will be glad to call at your convenience—or write for free bulletin.



*Typical Jobs*



Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.



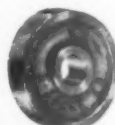
Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.



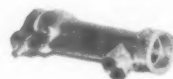
Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.



Bearing. A very small part. 2 micro-inch finish necessary.



Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.



Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping—and gave a straighter hole.

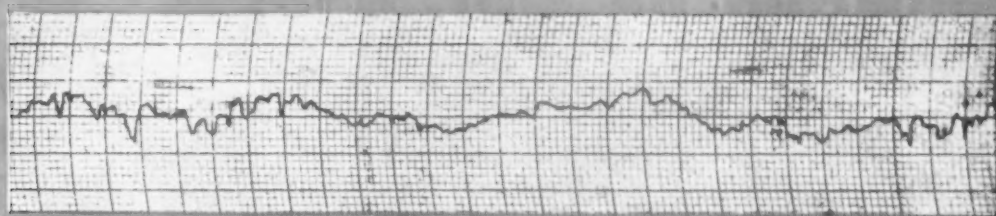
**SUNNEN**

**SUNNEN PRODUCTS COMPANY, 7932 Manchester Avenue, St. Louis, Missouri**

Canadian Factory: Chatham, Ontario



# Proof of a Better Finish



Each small square represents 1.0 micro inches. Micro inch r.m.s. = 0.9 - 1.6.

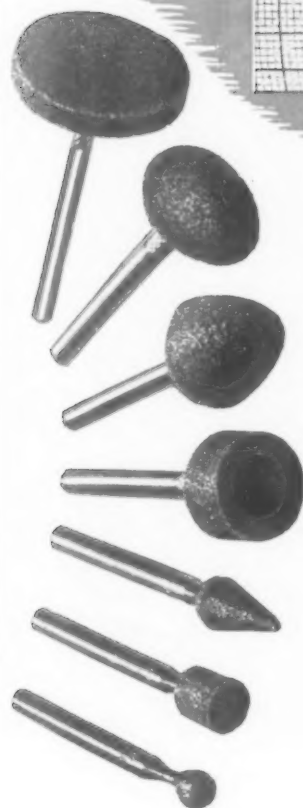
## Surface Analyzer Tape Proves you Get a Better Finish with Chicago Wheels

These results were obtained at a rate of 10 pieces per hour in an aircraft parts plant. Material, X-13-15, Rockwell 60 to 57, grinds out .006 to .007 stock. Chicago Wheel used,  $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{8}$ ", Grain 180, Grade L Arcite FV Bond. Spindle Speed 40,000 r.p.m. Lapping and super finishing eliminated on this job.

Can you match that finish? Sounds phenomenal, but you can do it with Chicago Wheels. And, the secret of their superiority lies in the new FV Bond, developed exclusively for Chicago Wheels, after 50 years' experience making wheels for the most accurate and precise applications.

### Here's What FV Bond Will Do for You

- ★ Reduce your wheel costs
- ★ Produce a better finish without sacrifice of production time—a finish so smooth that you can measure it in micro inches.



### TRIAL WHEEL FREE

Write or send the coupon today for a Chicago Wheel, made with this remarkable new FV Bond. Tell us grinder you use, size wheel and kind of material on which you will make your test.

For the duration, with full WPB approval, we are specializing on small sizes—anything up to 3" in diameter.

Write for Catalog and one of the new Engineering Survey Forms, a step in the direction of better finishing.

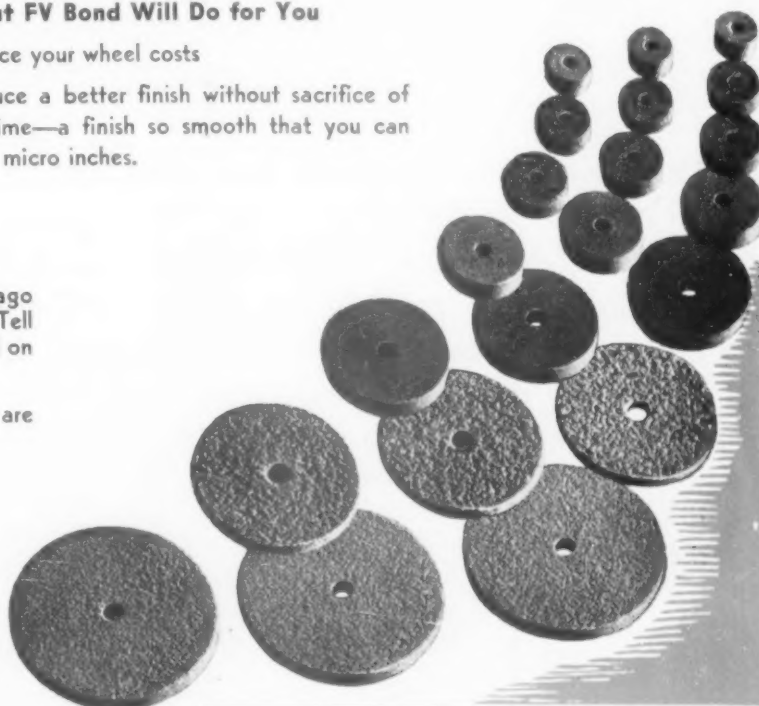


Half a Century of Specialization has Established our Reputation as the Small Wheel People of the Industry.

### CHICAGO WHEEL & MFG. CO.

America's Headquarters for Mounted Wheels and Small Grinding Wheels.

1101 W. Monroe St., Dept. TE, Chicago, Ill.



Send Catalog and Survey Form. Interested in  
 ( ) Mounted Wheels. ( ) Grinding Wheels.  
 ( ) Send Test Wheel. Size.....  
 Name .....  
 Address .....

TE-7

# Once "Bob" ran emergency errandas for you—and he will, again!



Here's Bob—"on leave" from his peacetime job representing your Industrial Supply Distributor — and helping *you* to win the War.

Back in the old days he used to drive around overtime looking for supplies to keep your War Production going on schedule. He *still* is driving around overtime. The "job" he is chauffeuring today doesn't look much like the trim little bus he drove in '42—but the extra skill he is acquiring will stand him

and you in good stead, come peace days again.

You can show your appreciation for Bob's good work—and for everything your local Distributor is doing to keep you supplied with vital materials—by 'phoning your orders directly to the Distributor instead of writing the factory. You will help the manufacturer to route his production efficiently—simplify deliveries—relieve transportation tie-ups.

Get your essential materials the *logical* way—

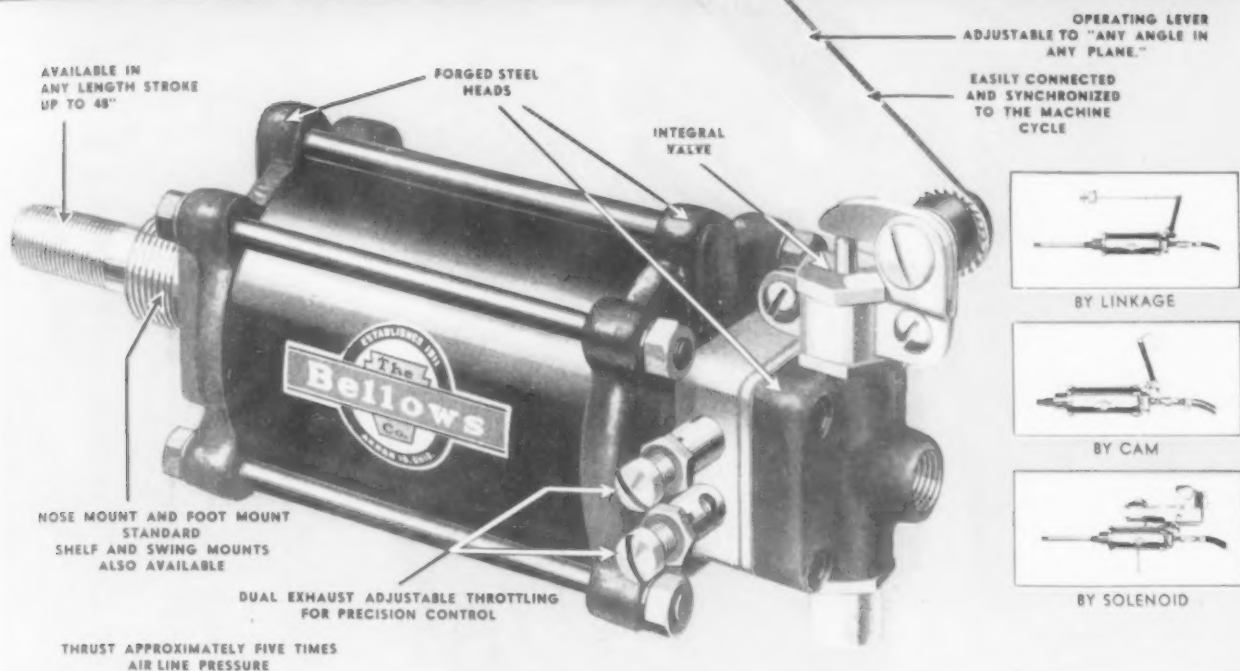
Telephone your  **FIRST!**



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TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES  
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6515 SECOND BLVD. DETROIT LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST. E.C.4



# THE NEW Bellows CONTROLLED-AIR MOTOR

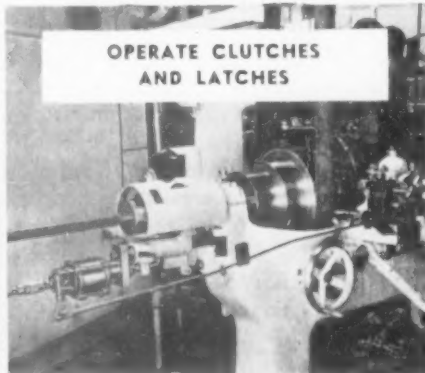
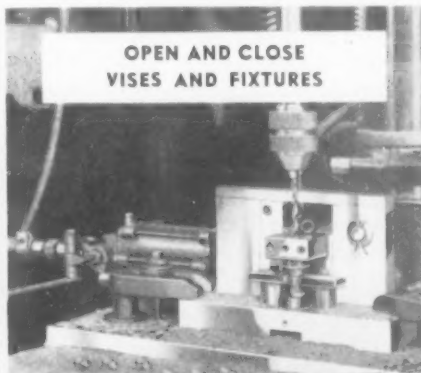
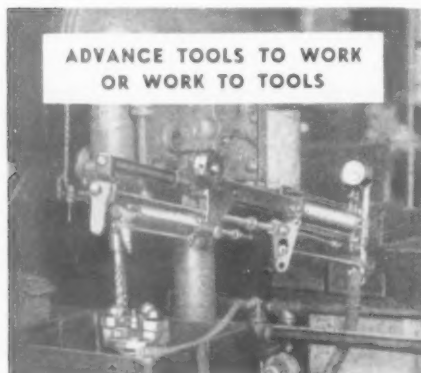


DEPARTING radically from conventional air cylinder practice the new Bellows Controlled-Air Motor is a complete, self-contained power unit, with integral valve, valve operating lever and speed controls . . . permitting full and positive control over all phases of its operation at all times.

Compact, simple in design and operation, Bellows Air Motors are readily adaptable to standard or special machines to perform a wide range of work. They

not only make manual operations automatic, but their precise, sensitive controls eliminate the need for skilled "feel" in many machine operations, permitting full use of the abilities of new and quickly trained operators. Reduced operator fatigue means fewer accidents—happier workers.

Write today for Bulletin BM-1, and free Photo-Facts File showing typical installations of Bellows Controlled-Air Devices.



## The Bellows Co.

ESTABLISHED 1911  
AKRON, OHIO



## *The Greatest American Legend...*

He's a man without a last name . . . a fellow known to every American kid as "Uncle." He is everywhere in his great land—yet no one has ever seen him. He is the great spirit of America . . . calm, quiet, peaceful and kindly until he gets his "dander" up—then he is determined, strong and his wrath is relentless.

His is the spirit of sacrifice, toil and patriotism. He has weathered many wars, trials and tribulations—yet he is indomitable. He stood with

Washington at Valley Forge . . . Perry at Lake Erie . . . Lincoln at Gettysburg . . . Pershing at the Marne . . . MacArthur at Bataan. He stands with every American to defend America.

Today, he stands with you . . . urging you to do more and more in the cause of Victory. To buy more War Bonds—to contribute to the

blood bank—to stamp out Black Markets—to defeat inflation—to be untiring in your efforts to hasten the day when our enemies will fall before our might. Ask yourself squarely if you couldn't be doing *more* to aid this great spirit—then *do* it.

Let's keep this *greatest* American legend . . . *GREAT!*

# APEX

THE APEX MACHINE AND TOOL COMPANY • DAYTON 2, OHIO

THE TOOL ENGINEER

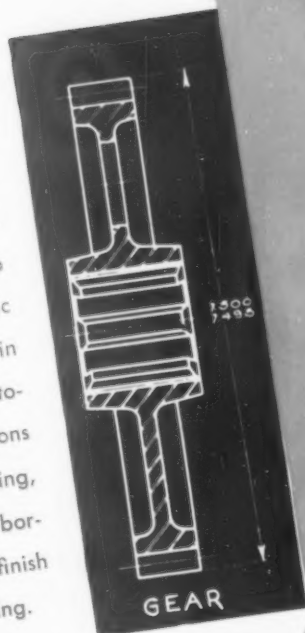


# FROM PRE-WAR PRODUCTS TO POST-WAR PROJECTS THROUGH P&J RE-TOOLING



## YESTERDAY

Tooled with this set-up for machining of tractor steering clutch driving gears, this P&J Two Spindle 12" Automatic produced two pieces in 5.38 minutes, floor-to-floor time. Operations included core drilling, rough and finish boring, rough and finish facing, and reaming.



## TOMORROW

### P&J REBUILDING SERVICE

Complete restoration of present P&J Automatics to original performance and accuracy is assured through P&J Rebuilding Service. Retooling while machines are in our shop for rebuilding can also be handled conveniently.

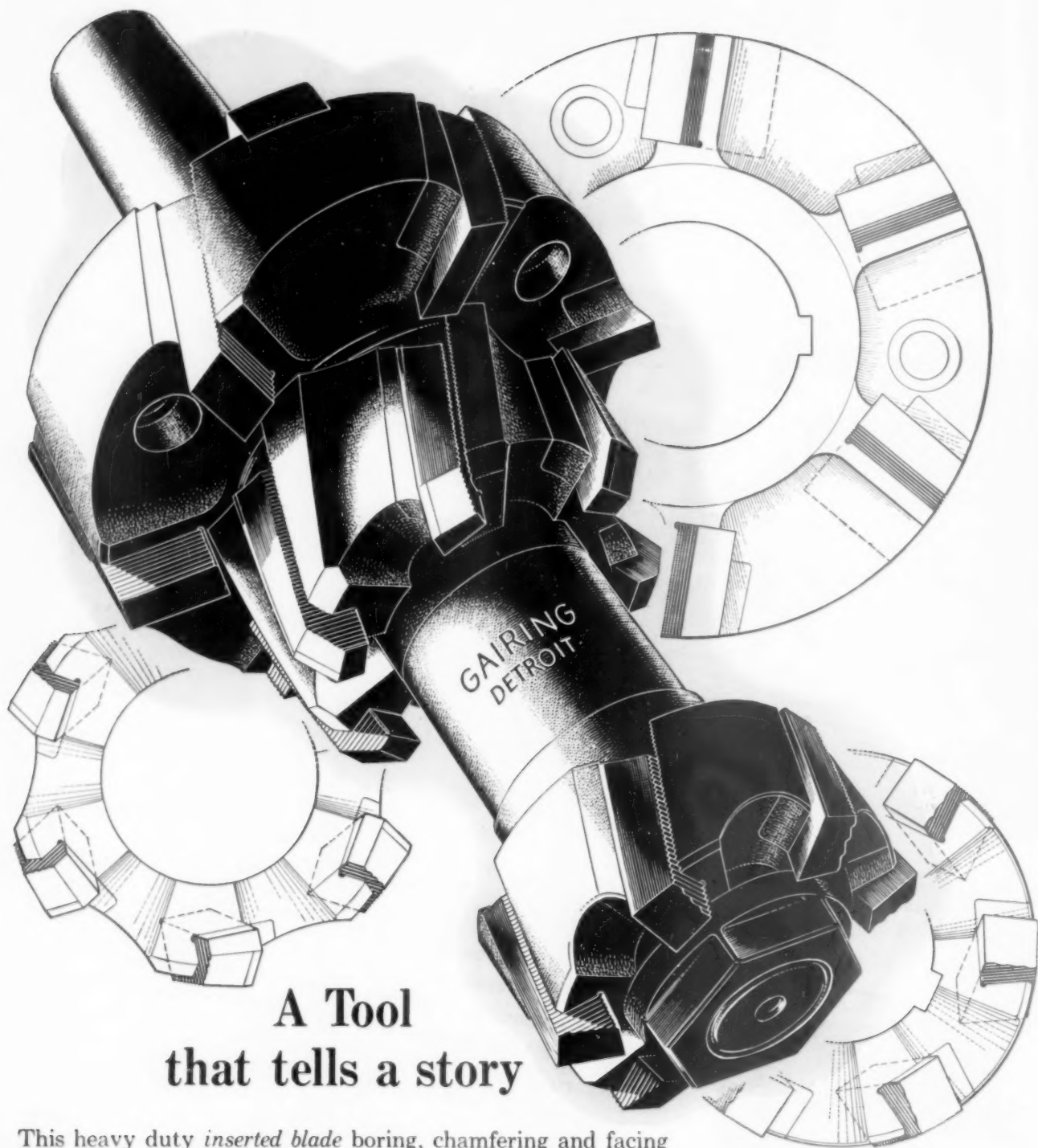


The versatility inherent in P&J machines, which makes possible fast and efficient production with original tooling, is a valuable asset when conversion to other work is involved. Advantage can be taken of this P&J feature on future work by having present machines re-tooled for tomorrow's jobs. Potter & Johnston engineers are not only tooling experts but are thoroughly familiar with the latest tooling possibilities of P&J machines and how to apply them toward attaining maximum production and economy on new or proposed work.

It will be to your advantage, when you consider conversion of your present P&J machines, to utilize P&J Retooling service, facilities and experience. If you are contemplating retooling for today's or tomorrow's requirements, consult P&J immediately.

**POTTER & JOHNSTON MACHINE CO.**  
Pawtucket, R. I., U.S.A.

The Bonds you BUY  
are the ones that count



## A Tool that tells a story

This heavy duty *inserted blade* boring, chamfering and facing tool was designed and custom built to solve a specific, high production metal cutting problem. Rugged simplicity and interchangeable cutter heads and blades are combined.

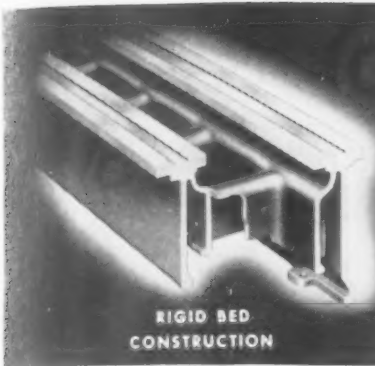
It is used here as a symbol because it is typical of the work Gairing engineers and craftsmen are doing in the design and precision manufacture of inserted blade cutters.

More than a quarter century of specialized experience in creating tools of this character has naturally taught us the particular advantages of all types of Gairing inserted blades and locks. We use all of them: the type best suited for the need.

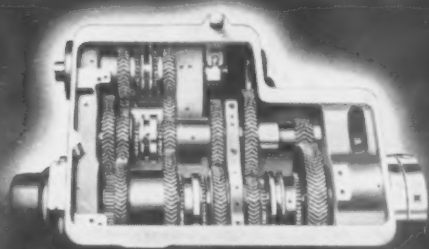
*Should you have a production job requiring the use of Inserted Blade Cutters, we'd like to discuss the matter with you • The Gairing Tool Company, Detroit 32, Michigan—Manufacturers of standard, special and Gair-Lock inserted blade cutting tools.*

# GAIRING

THE TOOL ENGINEER



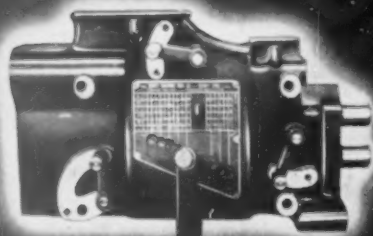
RIGID BED  
CONSTRUCTION



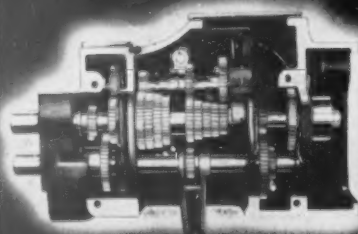
CONTINUOUS TOOTH 30° HELIX  
HERRINGBONE GEARED HEAD

*Sidney*

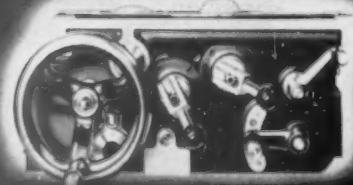
40TH ANNIVERSARY



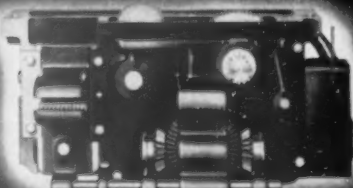
FRONT VIEW OF GEAR BOX



REAR VIEW OF GEAR BOX



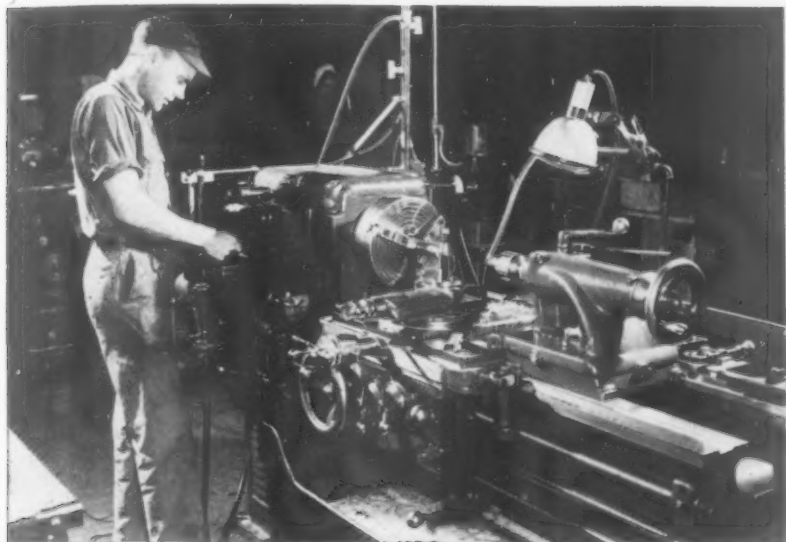
FRONT VIEW OF DOUBLE WALL APRON



REAR VIEW OF DOUBLE WALL APRON



SIDNEY COMPOUND REST



*Photo courtesy of Douglas Aircraft Company, Inc.*

**Winged Victory demands speed and precision**

## SIDNEY LATHES

● It would be difficult to find work requiring closer tolerances than airplane parts and the vast number of Sidney Lathes used by manufacturers of aircraft parts and in aircraft plants is indicative of the accuracy and dependability of Sidney Lathes for precision work.

The rigidity of Sidney Lathe bed with its four walls and cross girts at twelve inch intervals—the continuous tooth Herringbone Geared Headstock—the husky controls located centrally at the operator's fingertips provide all the essentials of strength—smooth flowing power—and ease of operation—to produce close tolerance work—easily—quickly. If your work requires aircraft precision put it on a Sidney Lathe.

*Bulletins on all sizes available.*



**The SIDNEY MACHINE TOOL Company**

*Builders of Precision Machinery*

**SIDNEY**

**ESTABLISHED 1904**

**OHIO**



# Faster Finishing



## SEVERANCE MIDGET MILLING CUTTERS TAKE DEEP SHARP BITES

On metal, wood or plastic parts, castings or patterns Severance cutters take deep sharp bites instead of merely burnishing. They throw off clean chips instead of dust.

For every type of finishing and deburring, Severance cutters do a quicker, faster job than ordinary rotary tools, rasps or burrs. Equally efficient with portable power tool, with stationery set-up or by hand.

Severance cutters can be successfully reground scores of times without losing their effective cutting qualities. If you are having difficulty in finishing any manufactured parts, send us samples and our engineers will design cutters to solve your problems.

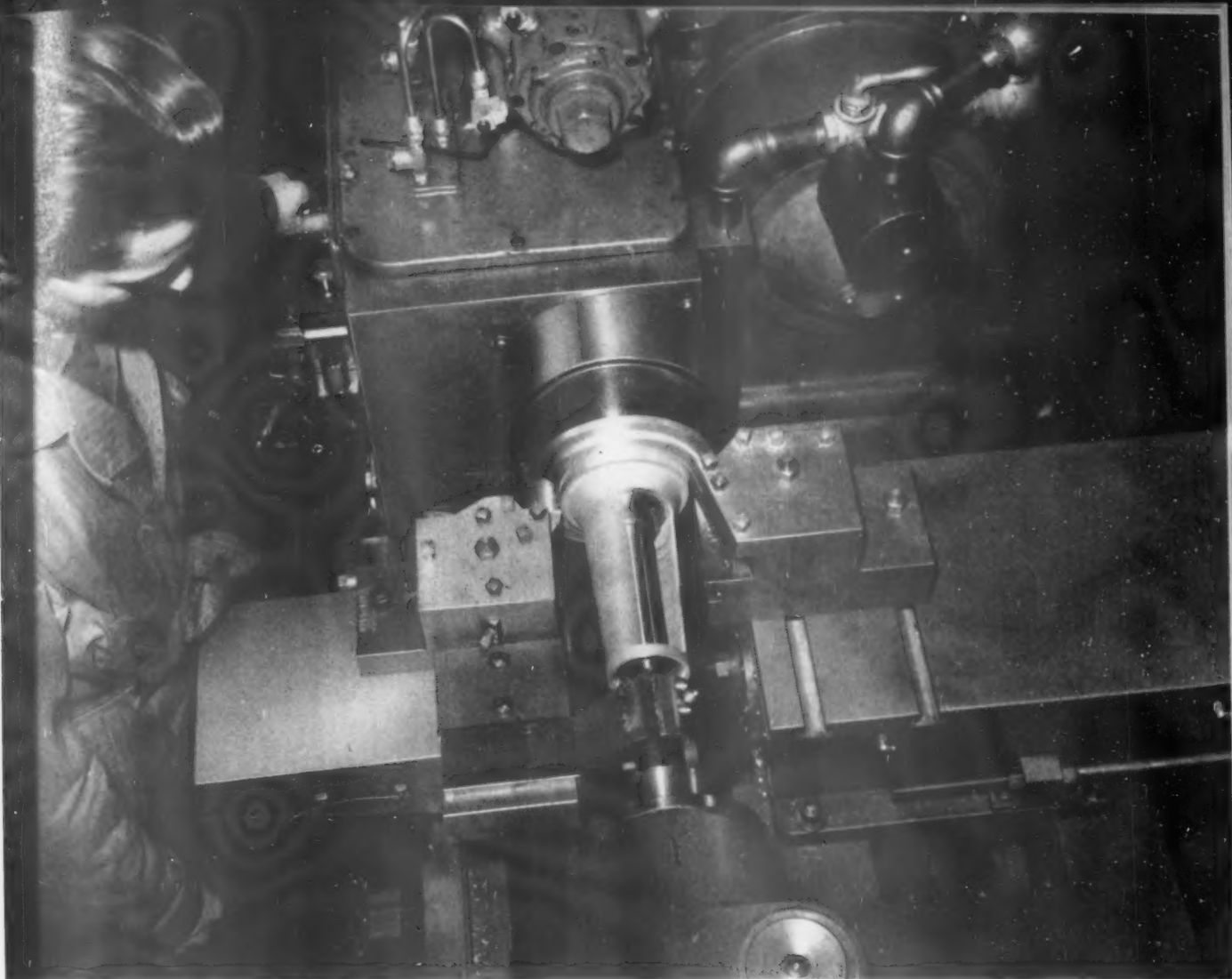
Severance "Carbide" Midget Milling Cutters are available in a wide variety of shapes and sizes.

# Severance



SEVERANCE MIDGET MILLING CUTTERS • PRECISION RE-GRINDING. Severance Tool Industries Inc., Saginaw, Mich. • Plants in Long Island City 1, N. Y.; Detroit 2, Mich.; Fort Wayne 8, Ind.; Chicago 6; and Los Angeles 21. In Canada: 60 Front Street West, Toronto, Ontario.





# DOUBLE DUTY

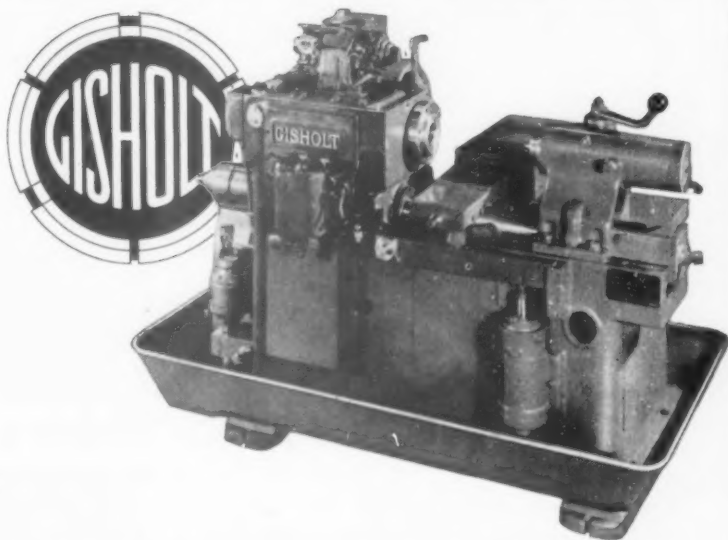
## WITH THE GISHOLT HYDRAULIC AUTOMATIC LATHE

**A**CTUALLY "double duty" is ultra-conservative for the production ability of this automatic lathe. For it can out-produce two, three, or even four manually operated machines wherever parts are to be turned out in large quantities.

What's more, its operation is so simple that one man, or woman, can tend two or three machines at a time. With but one small lever to control a whole cycle of operations, the training problem is practically eliminated. It's designed to handle a wide variety of between-centers and chucking work with high speed multiple cutting and extreme accuracy. If you can use this kind of production—to save man-power and cut costs—now and in the post-war period—ask for facts about the Gisholt Hydraulic Automatic Lathe.

### GISHOLT MACHINE COMPANY

1229 East Washington Ave. • Madison 3, Wis.

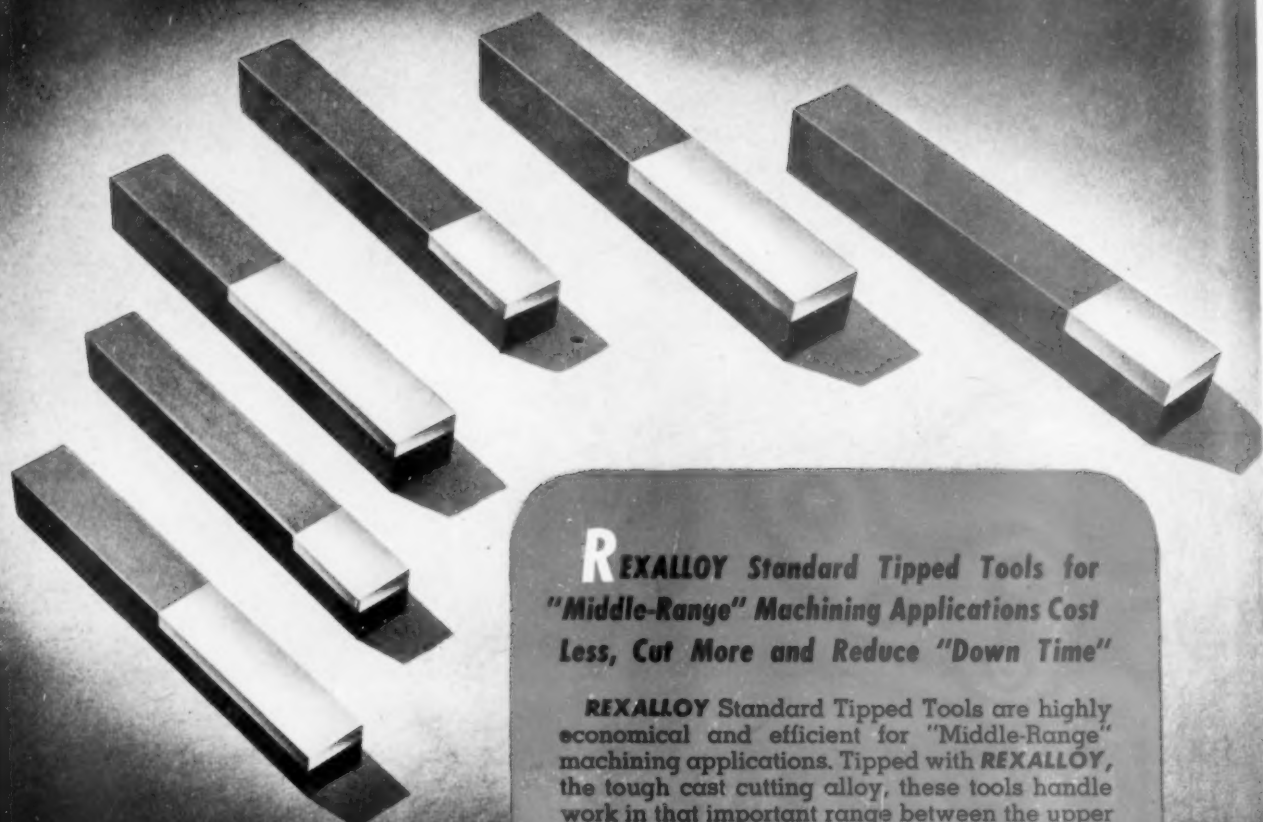


*Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning*

**TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES**

# REXALLOY

STANDARD TOOL BITS • STANDARD TIPPED TOOLS • SPECIAL TOOLS-TIPPED AND SOLID • CASTINGS



**REXALLOY TIPPED TOOLS  
LONG AND SHORT TIPS**



Crucible Steel Co. of America  
405 Lexington Ave., N. Y. 17, N. Y.

- ☐ Please mail me your new 28-page book, "REXALLOY CUTTING TOOLS".  
☐ We would like to discuss the possible use of REXALLOY in our plant.

Name

Firm

Address

City

## **R**EXALLOY Standard Tipped Tools for "Middle-Range" Machining Applications Cost Less, Cut More and Reduce "Down Time"

REXALLOY Standard Tipped Tools are highly economical and efficient for "Middle-Range" machining applications. Tipped with REXALLOY, the tough cast cutting alloy, these tools handle work in that important range between the upper limits of high speed steel and the lower limits of tungsten carbide. They cost less, of course, than solid cast cutting tool bits and are better able to stand excessive shock and unusual tool overhang. The high red-hardness of the REXALLOY tips permits vastly more speed, feed or depth of cut, better quality of finished product, and much less "down time" because of longer cutting life between grinds.

Your nearest Crucible Branch will gladly arrange for a REXALLOY Service Engineer to demonstrate REXALLOY Standard Tipped Tools, which are available from stock, competitively in your own plant. You stand to gain much by such a demonstration, so mail coupon today.

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More  
War  
Bonds

**CRUCIBLE STEEL COMPANY**



**of America**

Chrysler Building, 405 Lexington Ave., New York 17, N.Y.  
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HIGH SPEED, TOOL, STAINLESS, ALLOY, MACHINERY, SPECIAL PURPOSE STEELS

Are we sowing a crop of peacetime

## FOX MINES IN AMERICA?



In a rocky ravine somewhere on the invasion front, an American soldier lies dead . . . victim of an enemy fox mine . . . the supreme price of war. But peace, too, can have its booby traps, if we aren't careful now.

Are we sowing a crop of "fox mines" for our fighting men to come home to—the slow explosionless defeat of unemployment, hunger and hopelessness, the breadline and the bonus army?

Not if we think straight . . . not if we plan ahead now.

If you are a manufacturer, there is one thing that you can do at once: Have your production men and planners consult now with the engineers of the basic machine tool producers. They can help you in planning ahead for the difficult task of reconverting your own skills and machinery to an all-out peacetime production.

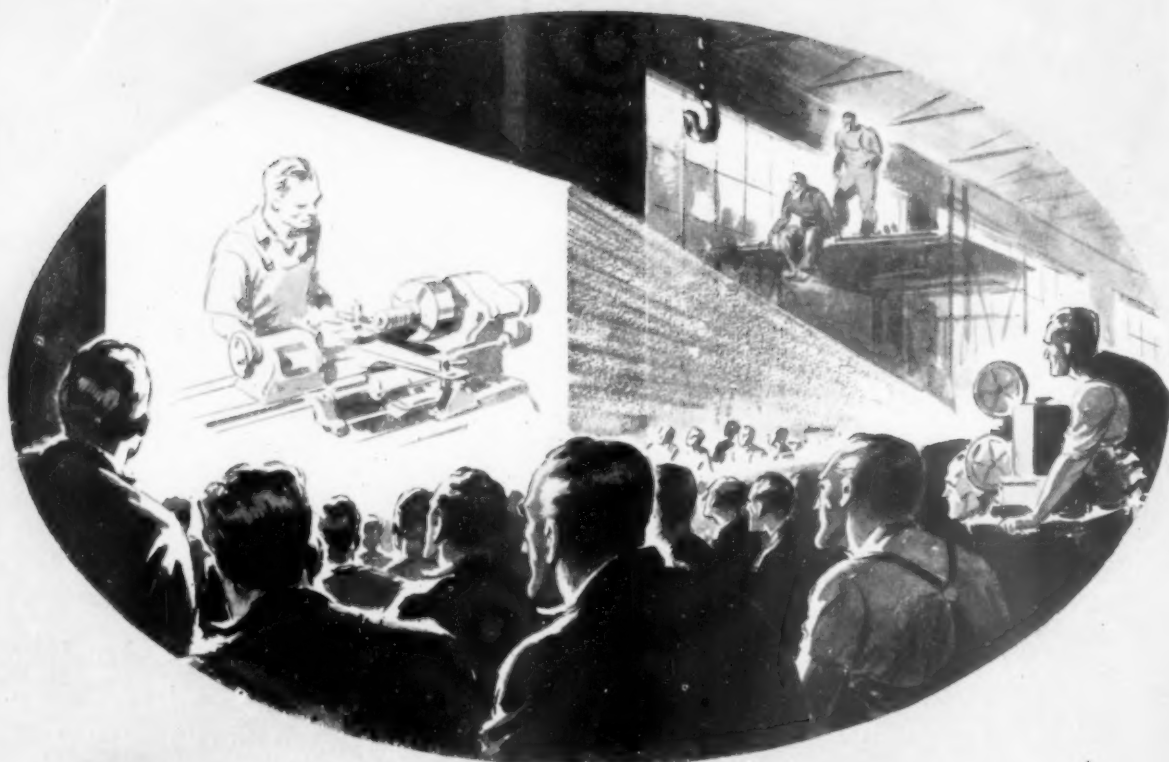
One of these engineers is a Bryant man. We urge you to call him today. For his specialized knowledge of internal grinding machinery is important to the manufacture of literally everything that will make this country a finer place: this is victory, a victory that it will be safe for our boys to come home to.



**BRYANT CHUCKING GRINDER COMPANY**

SPRINGFIELD  
VERMONT, U.S.A.





# *Speed the Training* OF NEW LATHE OPERATORS

Skilled manpower is one of the most critical of all war industry problems today. To replace the thousands of skilled machinists called to the services, new and inexperienced men and women workers must be trained to carry on the battle of production.

To help with the training of new lathe operators, South Bend offers a complete training program of sound films, reference books, manuals, wall charts, and bulletins. These represent an authoritative and effective course in lathe operation and modern shop practice. The 16 mm color, sound films have been adapted from South Bend's well known reference and text book, "How to Run a Lathe," now in its 42nd edition.

We are pleased to offer these films and instructional literature to industries and schools conducting pre-employment training classes.

## WRITE FOR INFORMATION ON THESE PRACTICAL TRAINING HELPS



### MOTION PICTURES—

"The Lathe" and "Plain Turning"—two 16 mm sound films in color on lathe operation. Available on a free loan basis for apprentice training. Showing time 20 minutes each. Write for Circular No. 8-A.

### HOW TO GET THE MOST OUT OF YOUR LATHE—

Specialized service bulletins on the care and operation of engine lathes. H-1, "Keep Your Lathe Clean"; H-2, "Oiling the Lathe"; H-3, "Installing

and Leveling the Lathe"; H-4, "Keep Your Lathe in Trim." Sample copies mailed on request.

### HOW TO RUN A LATHE—

A practical 128-page operator's handbook. 360 illustrations. Written in simple and non-technical style. Used as a shop text book by the Army, Navy and Air Corps. Price 25c. Sample copy free to apprentice supervisors.

### THREAD CUTTING—

21-page book, "How to Cut Screw Threads in the Lathe." Shows how to set up a lathe for cutting various pitches of screw threads, setting cutter bits, screw thread formulae, metric threads, etc. Price 10c. Sample copy free to apprentice supervisors.

### GRINDING CUTTER BITS—

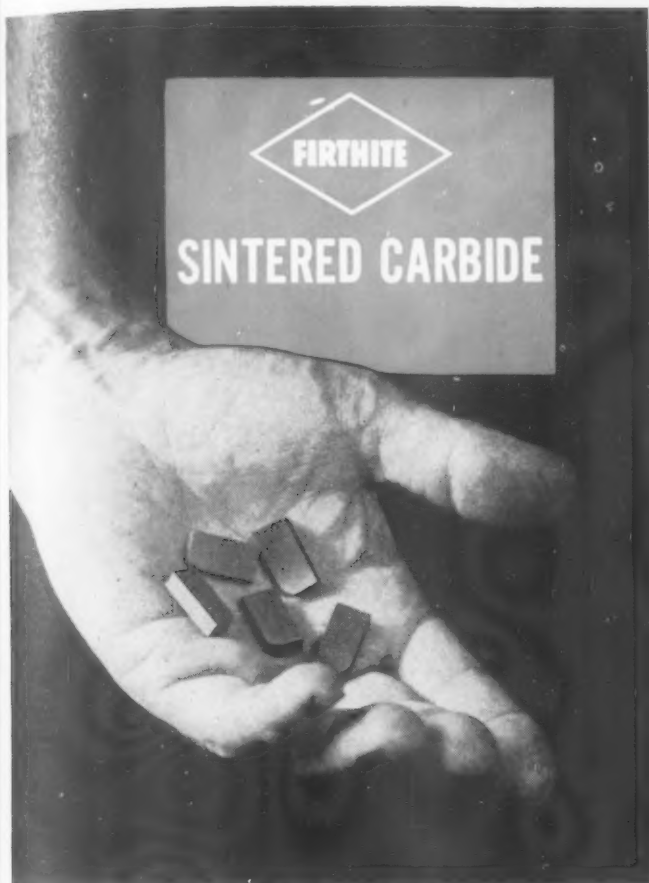
12-page book on grinding lathe tool cutter bits. Covers identification and application of various bits, methods of grinding, correct angles, etc. Price 10c. Sample copy free to apprentice supervisors.



**BUY WAR BONDS!**

**SOUTH BEND LATHE WORKS** • Lathe Builders for 37 Years • South Bend 22, Ind.





## THERE ARE PLACES FOR BOTH...

Firth-Sterling, long specialists in making steels for shop tooling, early recognized the possibilities of carbides as a means of extending the improvement in shop practice brought about by the super high-speed steel—CIRCLE C. **But, there is a place for both . . .**

Where the highest speeds are obtainable or materials are hardest, FIRTHITE is the "last word" in a cutting material. It is used at speeds up to ten times those possible with high-speed steels. Where speeds above average are permissible or materials are "on the hard side," CIRCLE C will cut *at least* 25% faster than ordinary grades of high-speed steel. Send for descriptive literature on these remarkable materials.

### *For instance:*

**FIRTHITE** removes 730 pounds of gray-iron casting metal per hour instead of 180 pounds;

*drills* a gun barrel in 23 minutes instead of 1 hour;

*enables* milling-cutters to run at 1,000 feet per minute instead of 100 feet with previous materials.

### *For instance:*

**CIRCLE C** machines hard die blocks in 28 hours instead of 42 hours . . . doubling production between grinds—versus regular high-speed steel;

*turns* two to ten times more pieces of heat-treated alloy steel between grinds than other high-speed steels.

***Firth-Sterling***  
STEEL COMPANY



Offices: McKeesport, Pa. NEW YORK - HARTFORD - PHILADELPHIA - CLEVELAND - DAYTON - DETROIT - CHICAGO - LOS ANGELES

# ...and Thread Gages, *too!*



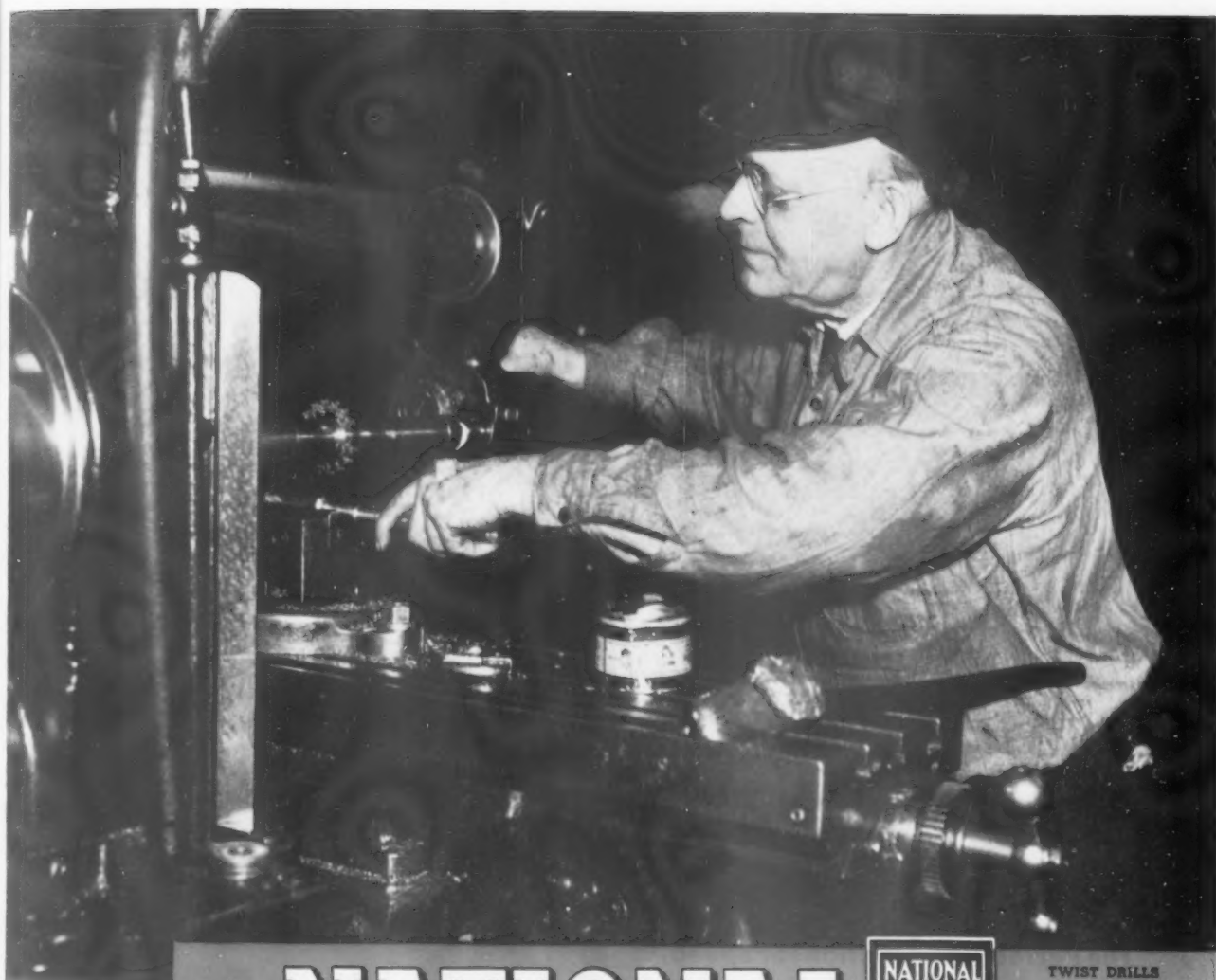
**VINCO CORPORATION, 8855 SCHAEFER HIGHWAY, DETROIT 27, MICH.**  
SALES OFFICES— **NEW YORK** **CLEVELAND** **CHICAGO**

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Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser  
• Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread  
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# HANDLE WITH CARE!

Hardened tools are tough—but cutting edges are brittle. Hammering them onto arbors or into tool holders can be as harmful as dropping them on machine tables or concrete floors. Until the last shot is fired, tools are weapons. Treat 'em right!



*National cutting tools, sold by leading Mill Supply Distributors, are tools of character.*

## NATIONAL



TWIST DRILLS  
REAMERS, HOBS  
MILLING CUTTERS  
COUNTERBORES  
SPECIAL TOOLS

### TWIST DRILL AND TOOL COMPANY

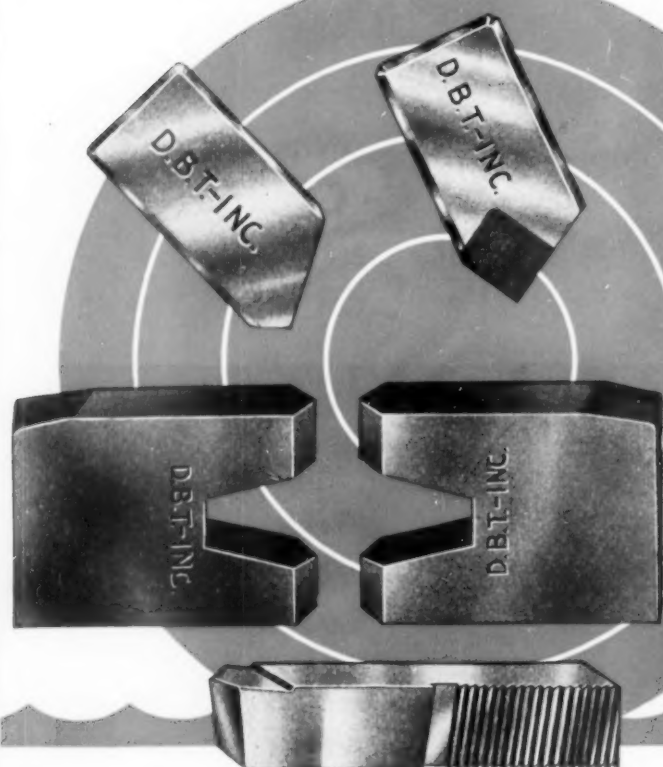
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Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

**FOR IMMEDIATE DELIVERY—**

**CORRECTLY-GROUND,  
PERFECT-FITTING...**



# **DAVIS** boring tool CUTTERS

**D**AVIS CUTTERS in Davis Boring Tools assure you absolute satisfaction! We make these Cutters in High Speed Steel, in Cobalt, or in special metals such as Stellite, Tungsten Carbide, Tantung, Rexalloy, etc. In the more popular sizes they are carried in stock for immediate shipment.

DAVIS CUTTERS are truly made for SUPER

boring. They are scientifically heat treated for uniform structure and hardness, and extreme care and accuracy are maintained throughout the process of manufacture. They're correctly ground, they fit perfectly, and they cost no more than other cutters. You'll be satisfied in every way with DAVIS CUTTERS. Order some today.

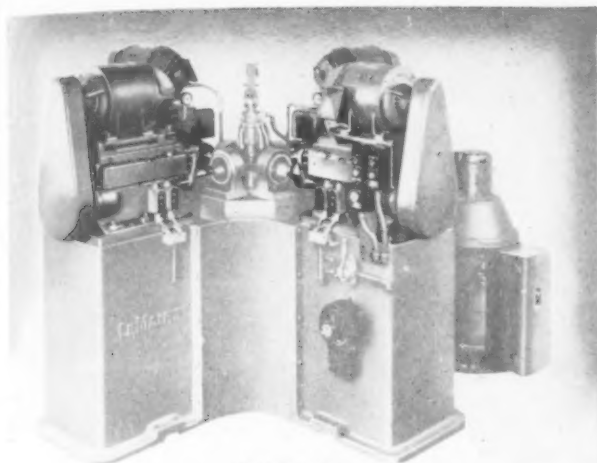
*The Perfect Combination for Speed,  
Accuracy, Economy—Davis Cutters  
in Davis Boring Tools.*



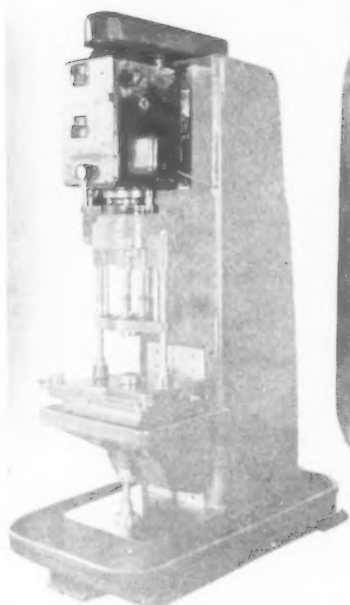
DAVIS BORING TOOL DIVISION ◀

LARKIN PACKER COMPANY, INC., ST. LOUIS 14, MO. ▶

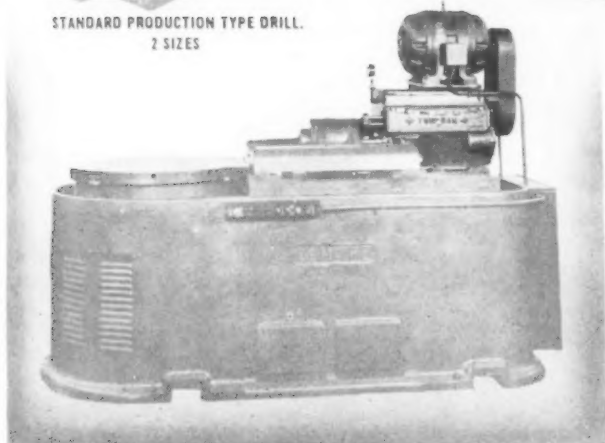
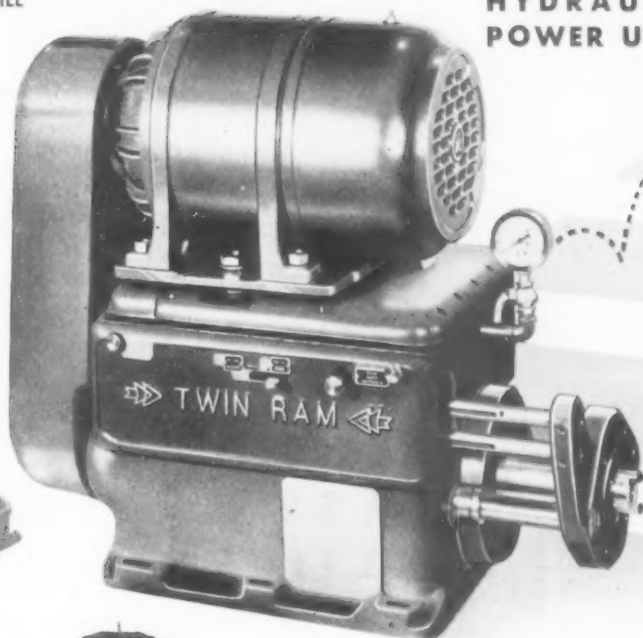




HOLLOW MILL



STANDARD PRODUCTION TYPE DRILL.  
2 SIZES



STANDARD SINGLE END AUTOMATIC INDEX MACHINE

We invite inquiries  
regarding postwar plans.

IT'S SIMPLE  
"To Make"  
A MACHINE NOW  
—if You Have a  
**TWIN RAM MASTER UNIT**

A COMPLETE  
SELF-CONTAINED  
HYDRAULIC  
POWER UNIT

**YOU** CAN change this unit from one base to another, or rearrange your setup on the same bed, as your requirements dictate. It's practically as flexible as a motor; only pick-off gears necessary for speed changes—units provide infinite feeds. Twin Ram Unit can be used for wide range of applications — drilling (single or multiple spindle), reaming, milling, hollow milling, boring, counter-boring, spotfacing. Uniform pressure behind load is always in a straight line — the two rams prevent twisting action. Two sizes available. Capacity up to 2" in steel. Can be made to operate manually or automatically by remote control — for either right or left hand operation — with spindle rotation in either direction.

Send for folder giving complete information — spindle speeds and feed rates.

**BUY  
WAR BONDS**

**L & M**aire TOOL & MFG. CO.

2663 S. TELEGRAPH ROAD  DEARBORN, MICHIGAN

**ENGINEERS AND BUILDERS OF PRODUCTION MACHINES**



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Material — 17 ST Aluminum.

Tolerance — .001" between any two points on pitch line.

Cutter — B-C 8-section Multiple-Tooth Rack Cutter, 24 pitch, each section 3" dia. 2" wide, 1 1/2" hole, on 24" arbor.

Machine — No. 3 Cincinnati Miller, Dial Type.

Set-up — Feed 1 3/8" per min., cutter speed 150 r.p.m.

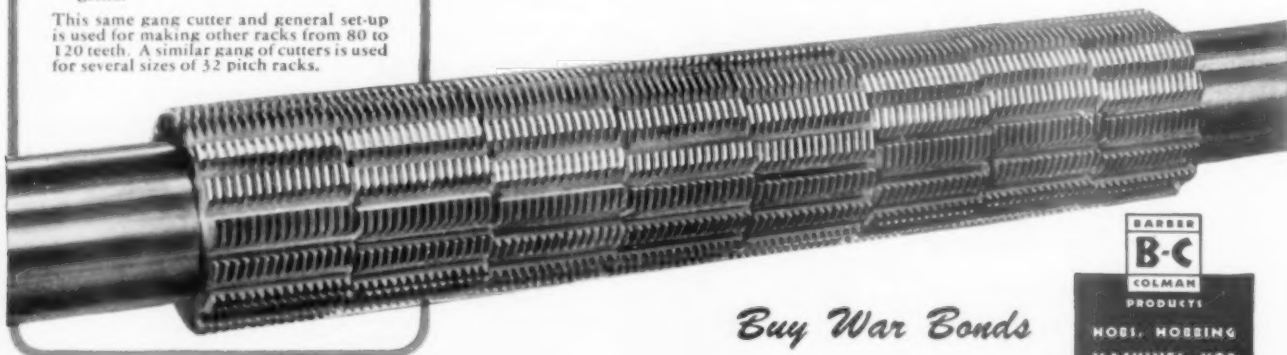
Time — 20 min. per load of 13, floor to floor.

Cutter Life — 1000 to 1500 pieces per grind.

This same gang cutter and general set-up is used for making other racks from 80 to 120 teeth. A similar gang of cutters is used for several sizes of 32 pitch racks.

## PRECISION RACKS CUT WITH THESE BARBER-COLMAN MULTIPLE RACK CUTTERS

A good example of simple production tooling as against tool room methods. They used to cut these racks one tooth at a time with a single row formed cutter, believing that this was necessary in order to obtain required accuracy. So it really was no great miracle to show a production increase of 8000% with B-C Multiple Cutters, over former production of four racks per day. On the other hand, it called for a good, well-made gang cutter to hold the accuracy — not over .001" error allowed between any two points on the pitch line. So, for accuracy AND production, use Barber-Colman Milling Cutters.



*Buy War Bonds*

# Barber-Colman Company

GENERAL OFFICES AND PLANT • 105 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

BARBER  
B-C  
COLMAN  
PRODUCTS

HOBBI, HOBBING  
MACHINES, HOB  
SHARPENING MA-  
CHINES, REAMERS,  
REAMER SHARP-  
ENING MACHINES,  
MILLING CUTTERS,  
SPECIAL TOOLS

1. "Replaces expensive machines"

2. "Replaces experienced workers"

3. "Sturdily built"

4. "Wide application"

5. "Maintains accuracy"

6. "Up-keep very light"



● The above advantages of Oster "RAPIDUCTION" Turret Lathes were mentioned by an owner of these *simplified*, low cost machines as important contributing "*reasons why*" his company has kept in pace with war production schedules under conditions of labor shortage obstacles. The case is typical of scores of other war production plants whose orders for more Oster "RAPIDUCTION" Lathes must be delivered before new customers can be supplied. Our distributors will be glad to explain the many advantages of Oster "RAPIDUCTION" Lathes but commitments on delivery dates cannot be made definite under existing conditions.

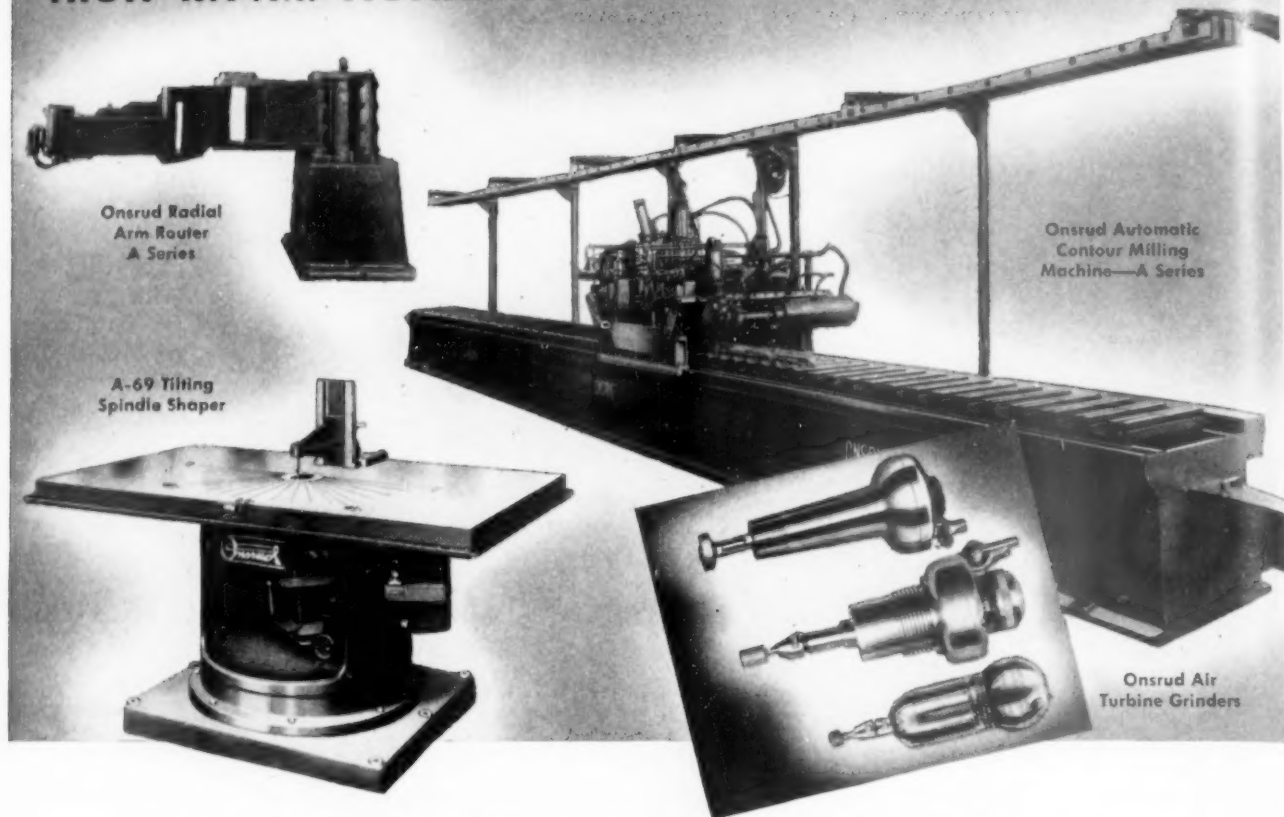
It is significant that the popularity of Oster "RAPIDUCTION" Lathes is the greatest "obstacle" to our desire to serve you promptly. The Oster Manufacturing Company, 2063 East 61st Street, Cleveland 3, Ohio, U.S.A.



# "Rapiduction" LATHES



## HIGH R.P.M. NONFERROUS METAL WORKING MACHINES



Onsrud Radial  
Arm Router  
A Series

A-69 Tilting  
Spindle Shaper

Onsrud Automatic  
Contour Milling  
Machine—A Series

Onsrud Air  
Turbine Grinders

### These Bulletins Give You Complete Information



If you've been wanting complete information on the high speed machines that the metalworking publications have been writing about recently, take advantage of this Onsrud offer. Write for the machine bulletins described below. Some of these machines, of course, were de-

#### MILLING

This gives the facts about Onsrud Automatic Contour Milling Machines. Extruded wing spars, some as long as 50 feet, are milled in a matter of minutes. Four cutter motor assemblies on a traveling carriage make numerous types of milling cuts—face, slot, twist and taper, as well as cut-outs.

#### SHAPING

Actually a type of milling machine, the cutter of the Onsrud A-69 Shaper may be set at any off-vertical angle up to 20° toward either the front or back of the machine. Used for beveling as well as trimming channels and similar parts. Cutters turn at 10,800 RPM.

signed specifically for aluminum alloy aircraft parts production. But the principles involved in machine design apply in all industries—wherever the light metals must be machined. It may prove of considerable advantage to you to have this data now.

#### ROUTING

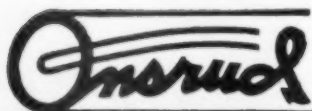
How would you plan the job of cutting out to exact size and shape a production run of parts from flat sheet stock? Large Onsrud Radial Arm Routers cut or rout work from single nonferrous flat sheets up to 4' x 12' in size. Router bits are direct high cycle motor driven at 15,000 RPM. Machines like these, with drill heads, perform drilling operations under a similar procedure.

#### GRINDING

Onsrud air turbine Grinders have spindle speeds ranging from 38,000 to 75,000 RPM. These are successfully used on all types of materials. The wide range of high speeds provides the proper speed for even grinding wheels below 1/4" diameter. Units like this are machine mounted for such operations as precision die grinding.



Write for bulletins today. Manufacturers with present or contemplated production problems involving the machining of nonferrous metal alloys or related materials are invited to write to Onsrud for information and assistance now.



#### ONSRUD MACHINE WORKS, INC.

3927 Palmer Street, Chicago 47, Illinois  
Sales Offices in All Principal Cities

**MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION**





**T**hat's right . . . take a hair, magnify it 62.5 times . . . result — a husky rod. This is just what Jones & Lamson Optical Comparators do to those tiny dimensions that are difficult, or even impossible, to measure by any other means.

If you are a manufacturer of parts that must be right — to a hair — it will pay to investigate Jones & Lamson Comparators. These machines are designed for use in the shop (they don't have to be babied), and they can be used as easily as a mechanic's scale.

Jones & Lamson inspection engineers are at your service to study your particular measurement and inspection problems. Call on them today!

MEASUREMENT AND INSPECTION—BEYOND A SHADOW OF A DOUBT!



This book, "Beyond a Shadow of a Doubt" will be sent to executives asking for it on their firm letterhead.



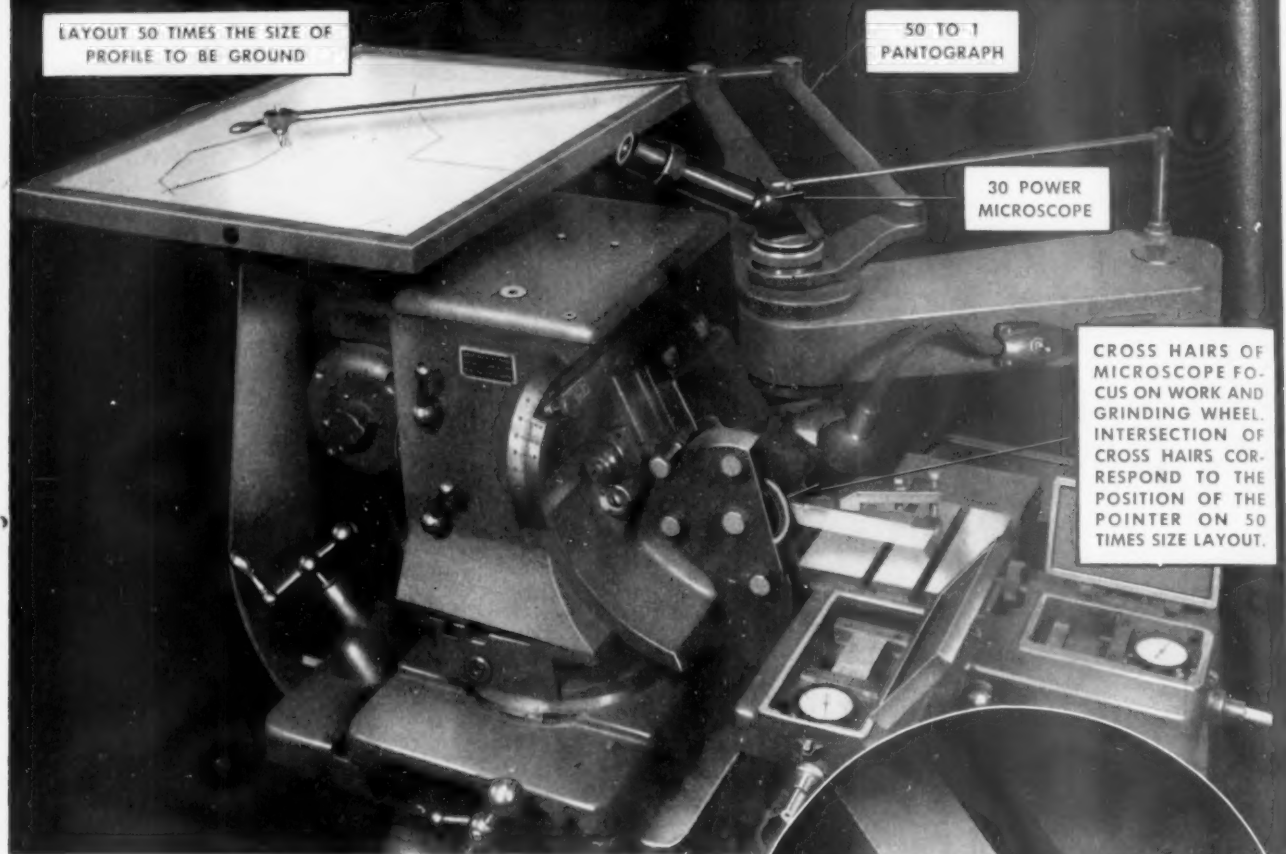
PROFIT-PRODUCING  
MACHINE TOOLS

**JONES & LAMSON**  
**MACHINE COMPANY**

**OPTICAL COMPARATORS** Springfield,  
Vermont, U.S.A.

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

# THESE Wickman PRINCIPLES



## Make Possible The ACCURATE GRINDING Of Profiles Such As These In Tungsten-Carbide Or Other Hard Metals

● The Wickman Profile Grinder has for a number of years proved exceptionally efficient for the grinding of irregular shaped contours on flat or circular form tools, male and female profile gages, punches, open and sectional die segments, etc.

● Accuracy is held to within  $\pm .0005''$ . This accuracy is not affected by wheel wear and no special shapes or radius dresser need be used.

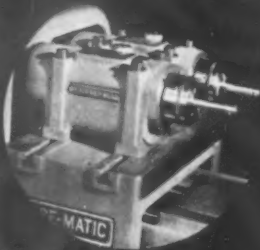
● Finished parts can be checked against the layout without removal from the machine. Reversing the operations followed in grinding, layouts can be made of parts having previously undetermined profiles.

*Literature Containing Full Information Is Yours for the Asking*

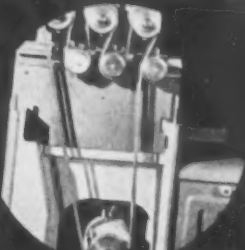
**THE Wickman**  
CORPORATION

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# Meet Specific requirements of every job ON VERSATILE HEALD BORE-MATICS




Adjustable Boring Head Mounting on Slotted Bridges.



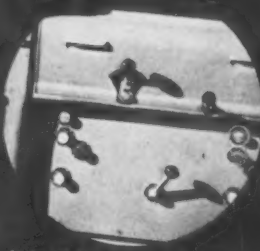
Flexible V-Belt Head Drive Gives Wide Speed Range.



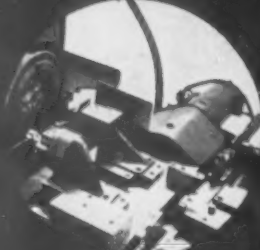
Available with Single End or Double End Bases.



Hydraulic Table Drive permits complete range of feeds.



Units of Hydraulic Box readily changed for various cycles.

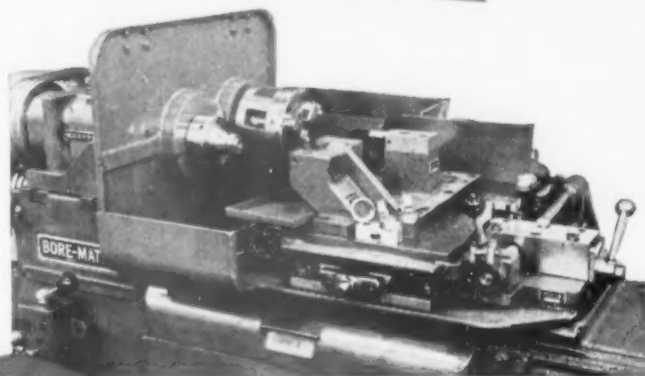


Auxiliary Hydraulic Power for Cross Slides, Tool Slides, etc.

**Plus**  
Flexible Cycles  
— Manual or Automatic

## V. F. 2\* ALL-PURPOSE VERSATILITY FROM BASIC BORE-MATIC DESIGN

BORIZE ON BORE-MATICS . . . that means improved results on all operations . . . means better accuracy, finish, production for boring, turning, facing, chamfering, grooving, fly cutting, for straight and taper surfaces, for curves and irregular shapes. All these operations would not be possible on a machine with fixed, rigid design. On Heald Bore-Matics, basic design is unusually flexible . . . has unusual versatility that permits individual arrangement to suit specific requirements of every job. Versatility like . . . slotted bridges holding one or more boring heads for single or multiple operation . . . flexible, adaptable drive to heads by V-belts . . . single end or double end bases for single end or double end operations . . . hydraulic feeds, infinitely variable . . . auxiliary hydraulic power to operate cross-slides, tool slides, tool back-off clamping . . . machine cycles, manual or automatic to suit your requirements. Get the facts on Heald Bore-Matics now. Write The Heald Machine Co., Worcester 6, Mass.

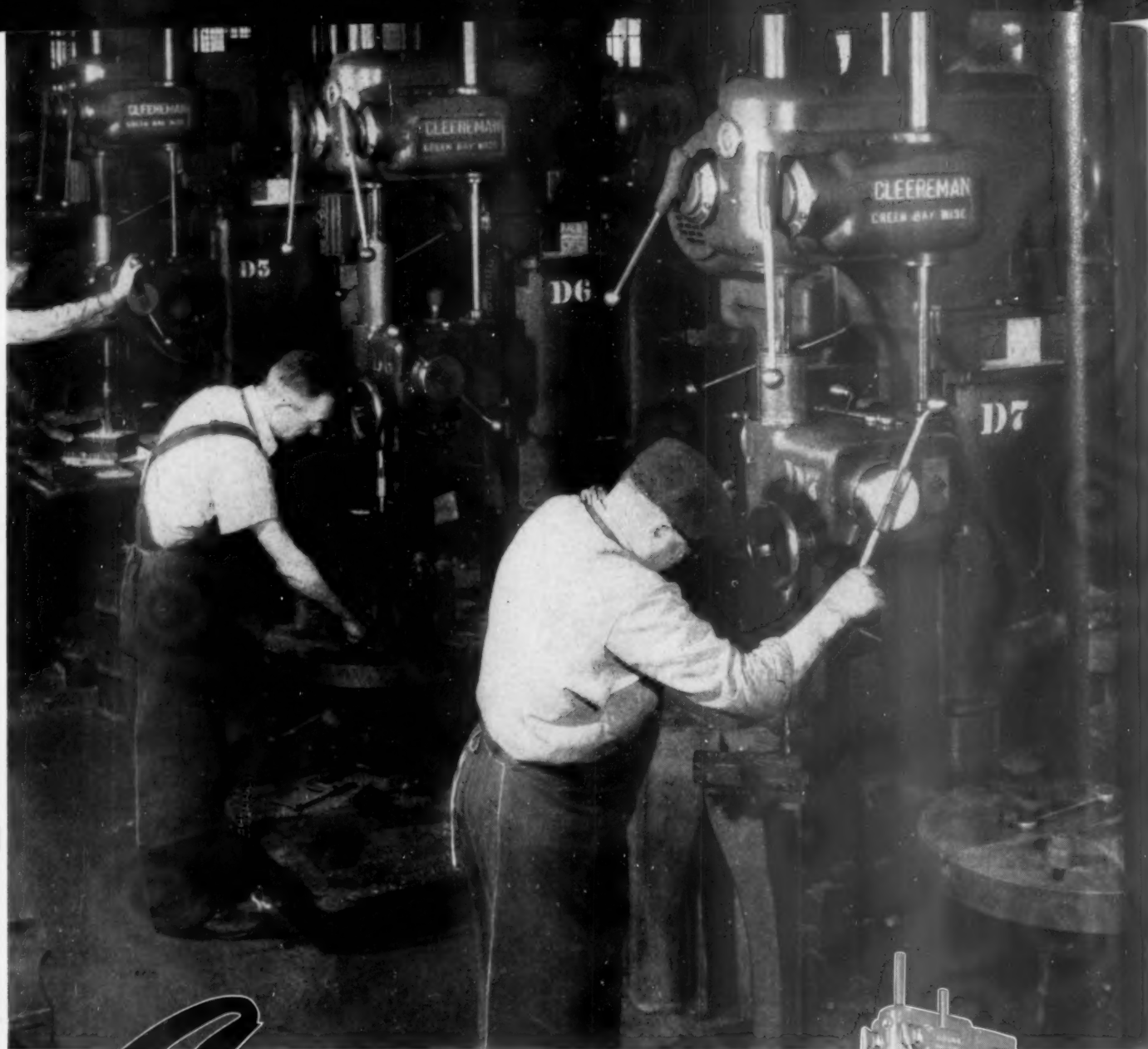


This is functional versatility. Heald engineers took a standard basic single end Bore-Matic, mounted two heads on the bridge with special rotating fixtures, designed special tools, put them on a hydraulic cross-slide. Final result . . . completely automatic turning, boring, facing, necking, forming of bearing liners in two-stage progressive operations.

# HEALD *Bore-Matics*

THE MOST VERSATILE MACHINE TOOL





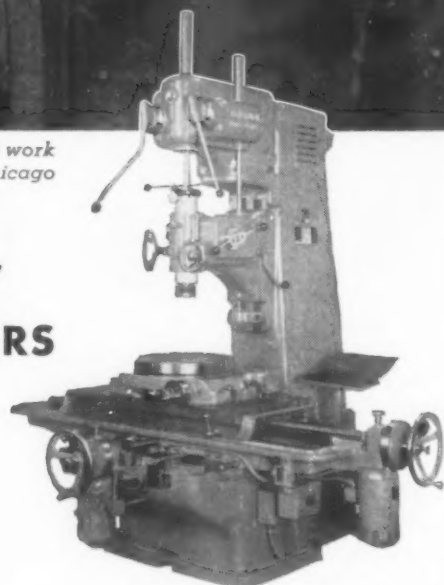
*A battery of three Cleereman Drilling Machines at work in the plant of the Armstrong-Blum Mfg. Co., Chicago*

# *Cleereman*

## **DRILLING MACHINES AND JIG BORERS**

Speed of operation, high efficiency, unexcelled accuracy, extreme range of adaptability, and long working life are the dividends collected by the many users of Cleereman Drilling Machines and Jig Borers.

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*Cleereman Jig Borer*

**BRYANT MACHINERY & ENGINEERING COMPANY**  
*Associated with* **CLEEREMAN MACHINE TOOL COMPANY**

*General Sales Offices* 400 W. Madison St. • • • Chicago 6 • Ill. • U. S. A.





# *Jarvis* **POWER TOOLS** and **GROUND FROM THE SOLID ROTARY FILES**

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**Jarvis "Tungsten Carbide" Rotary Files:** The hardest, fastest Rotary File ever put into a flexible shaft machine! When the original cost of these tungsten carbide tools is spread over extremely long-life operation and subsequent regrindings, your rotary file costs drop to a fraction of those incurred with the use of ordinary high speed steel files.

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Jarvis Hy-speed Case  
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**THE CHARLES L. JARVIS CO., MIDDLETOWN, CONN.**  
TAPPING ATTACHMENTS • FLEXIBLE SHAFT MACHINES • GROUND ROTARY FILES  
QUICK CHANGE CHUCKS AND COLLETS

# NEW NORTON *Vitrified* DIAMOND HONE



**E**XTENSIVE field tests prove that this new Vitrified Diamond Hand Hone—a strictly Norton development—has these advantages for touching-up carbide tools:

1. **Up to 50% faster cutting action** than resinoid type hand hones—and even more compared to metal hand hones.
2. **Up to double the life** of resinoid bond hand hones for the same depth of diamond section.
3. **Few dressings required.** Metal diamond hones tend to dull and must be dressed frequently.

Available in stock in two types: diamond section one end—320 grit; diamond sections both ends—320 grit and 400 grit. Call your Norton distributor or Norton abrasive engineer.

**NORTON COMPANY**

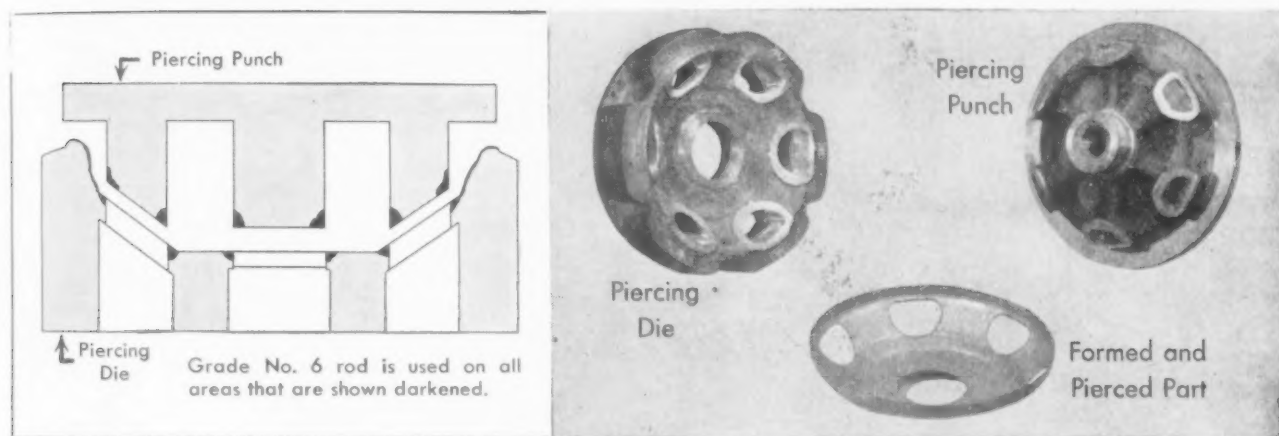
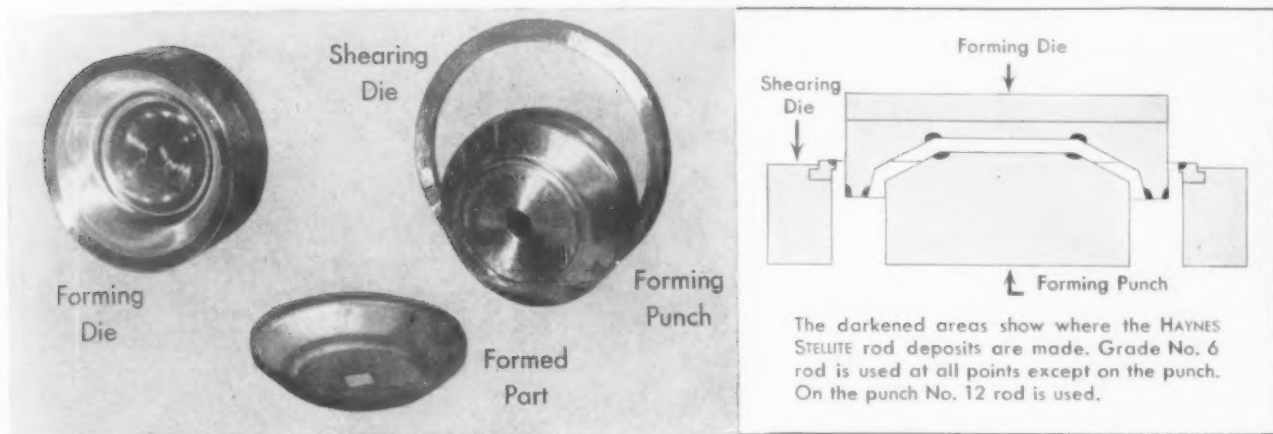
**Worcester 6, Mass.**

*Distributors in All Principal Cities*

W-961A

**NORTON ABRASIVES**

# Hard-Facing saves \$2,500 on these Truck Wheel Dies ...and they last 3 times as long



*The old way cost \$4,300.* Formerly these two sets of dies for making truck wheels were fabricated of special steels. They produced only 15,000 blanks.

*The new way costs \$1,800.* By making these dies of carbon steels and hard-facing working surfaces with HAYNES STELLITE rods a saving of \$2,500 is realized in initial costs. In addition,

these hard-faced dies turn out 50,000 pieces.

Hard-facing with HAYNES STELLITE rods is an economical way of increasing life in tools, dies, and many other metal parts subjected to extreme wear and abrasion. You can get more information about hard-facing and how to do it by writing for the booklet "Hard-Facing With HAYNES STELLITE Products."



## HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N. Y.  Kokomo, Ind.

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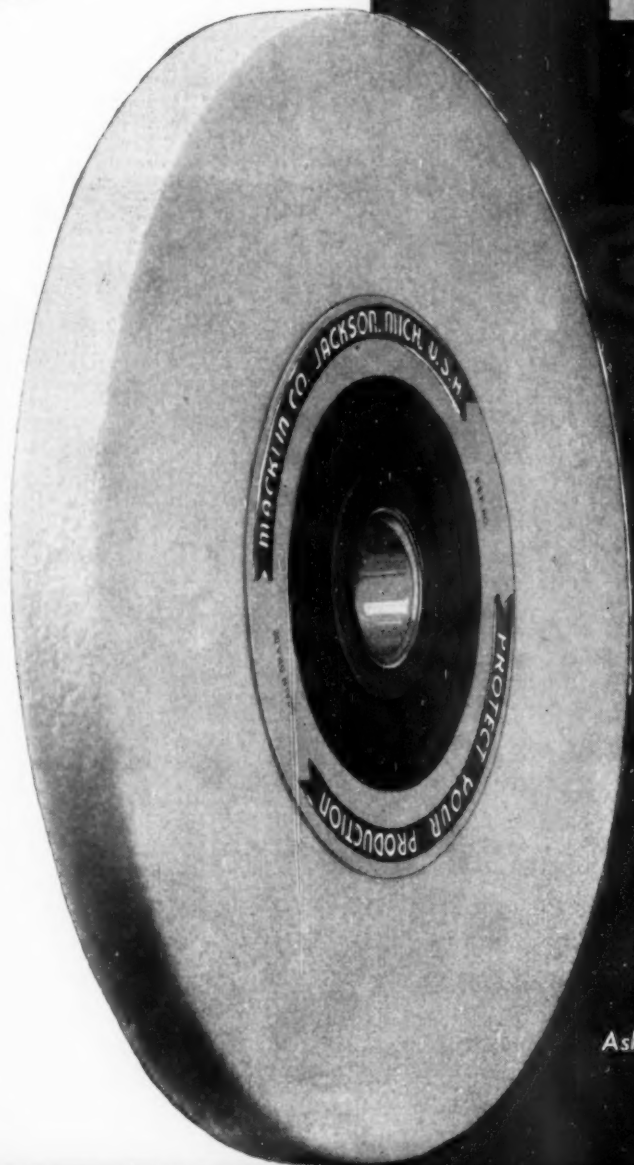
HARD-FACING RODS FOR EVERY PURPOSE

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

JULY, 1944

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# MACKLIN



Macklin segments are available for all types of segmental chucks. They are tops for surface grinding.

**M**ACKLIN HIGH QUALITY WHEELS  
FOR EVERY GRINDING PURPOSE WILL

***"Protect Your Production"***

Ask for the services of a Macklin Field Engineer

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# HARDINGE

High Speed Precision

## LATHE

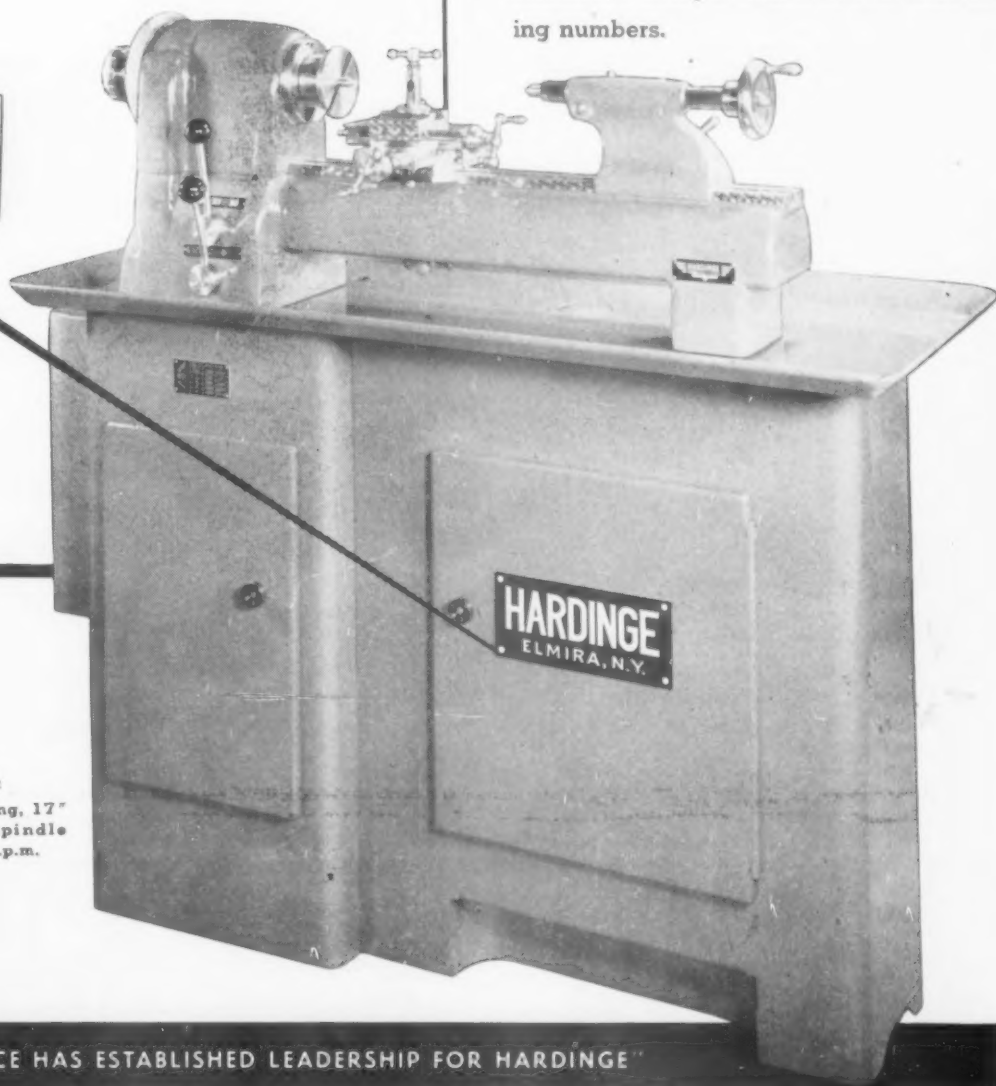
is designed for accurate  
tool room work

**D**esigned to meet requirements of extreme lasting accuracy, high spindle speeds and the ease in operation required for the smaller diameter work range found in every tool room, laboratory and production department.

The simplicity of operation enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling. Your larger, expensive equipment will not meet all of the foregoing requirements necessary for practical results and proper economy.

Because of the many advantages found through actual use, Hardinge Precision Lathes are being installed in ever increasing numbers.

**HARDINGE**  
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**SPECIFICATIONS:**

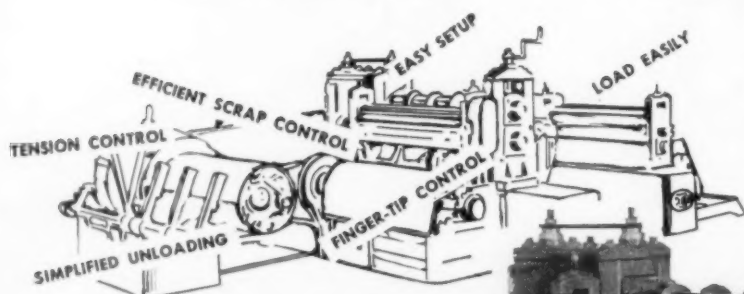
1" collet capacity, 9" swing, 17" center distance, eight spindle speeds from 100 to 4000 r.p.m.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



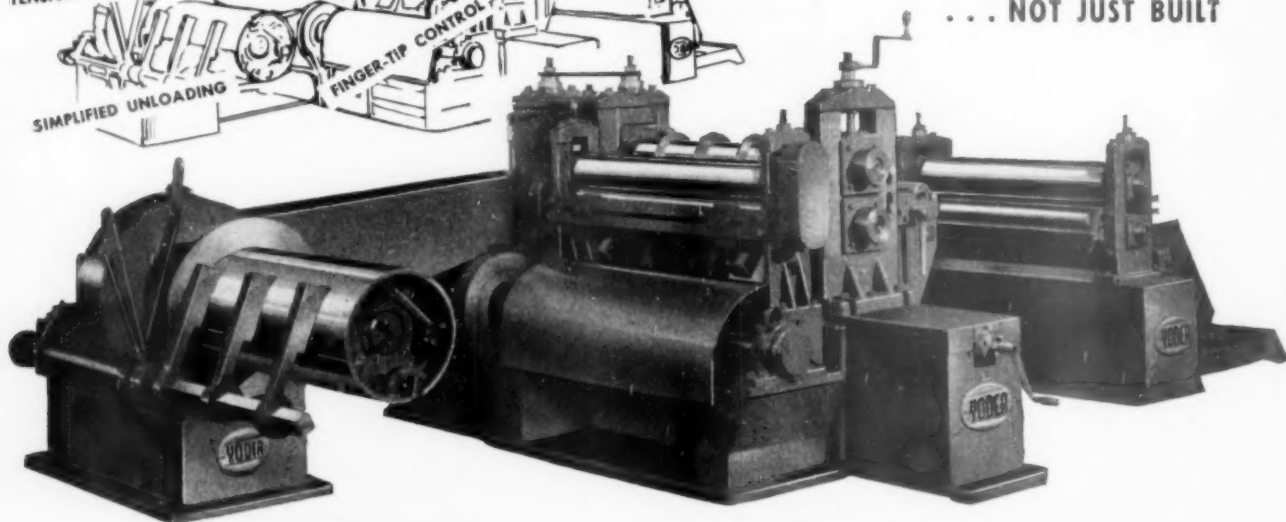
# "Yoder MAKES IT EASY FOR THE OPERATOR TO DO A GOOD JOB OF SLITTING"

Write for bulletin giving  
details of these points.



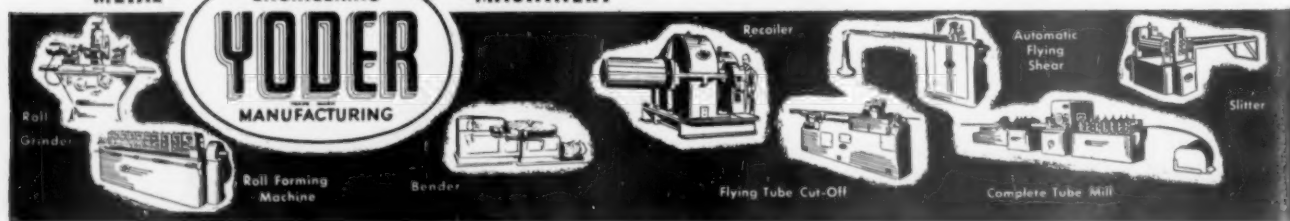
Yoder slitting lines are engineered for "production with a smile". . . for easy loading of even the heaviest stock coils . . . for quick, simple set-up . . . skillful removal of finished coils. Full synchronized control of all units is at the operator's finger tips. Positive tension control gauged to ideal cutting and rewinding conditions. Edge trim is automatically chopped to convenient scrap. Slit coils are accurately uniform.

**YODER SLITTING LINES ARE ENGINEERED  
. . . NOT JUST BUILT**

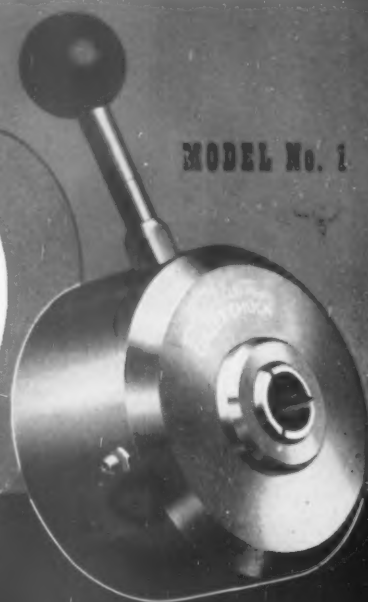


**METAL • WORKING • PRODUCTION • MACHINERY**

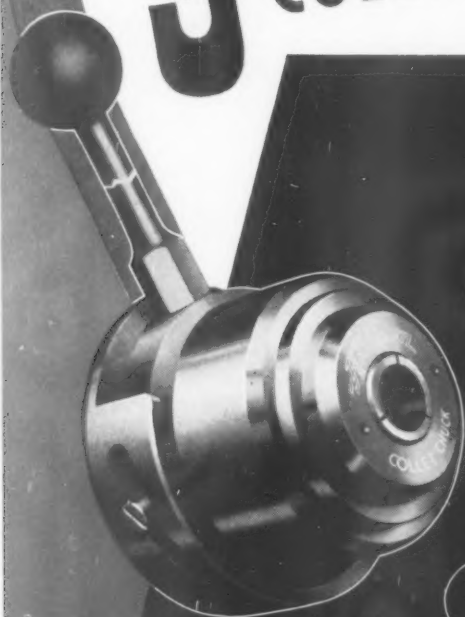
THE YODER CO., 5500 Walworth Ave., Cleveland 2, Ohio, U. S. A.



# 3 ALLISON COLLET CHUCKS



MODEL No. 1



MODEL No. 2

**MODEL No. 1** For 1½" 8-thread spindle lathes — with 7/8" collet capacity — is unsurpassed as a combination chuck for either first or second operation work.

**MODEL No. 2** For 1½" 8-thread spindle lathes — with 7/8" collet capacity — full circular low pressure cam activates the collet closing mechanism, thus giving any desired gripping pressure.

**MODEL No. 3** For 2½" spindles and under — with 1⅝" collet capacity — has same mechanical advantages as the #2 chuck.

All Allison Collet Chuck closing handles operate at right angles to ways of lathe bed.



MODEL No. 3

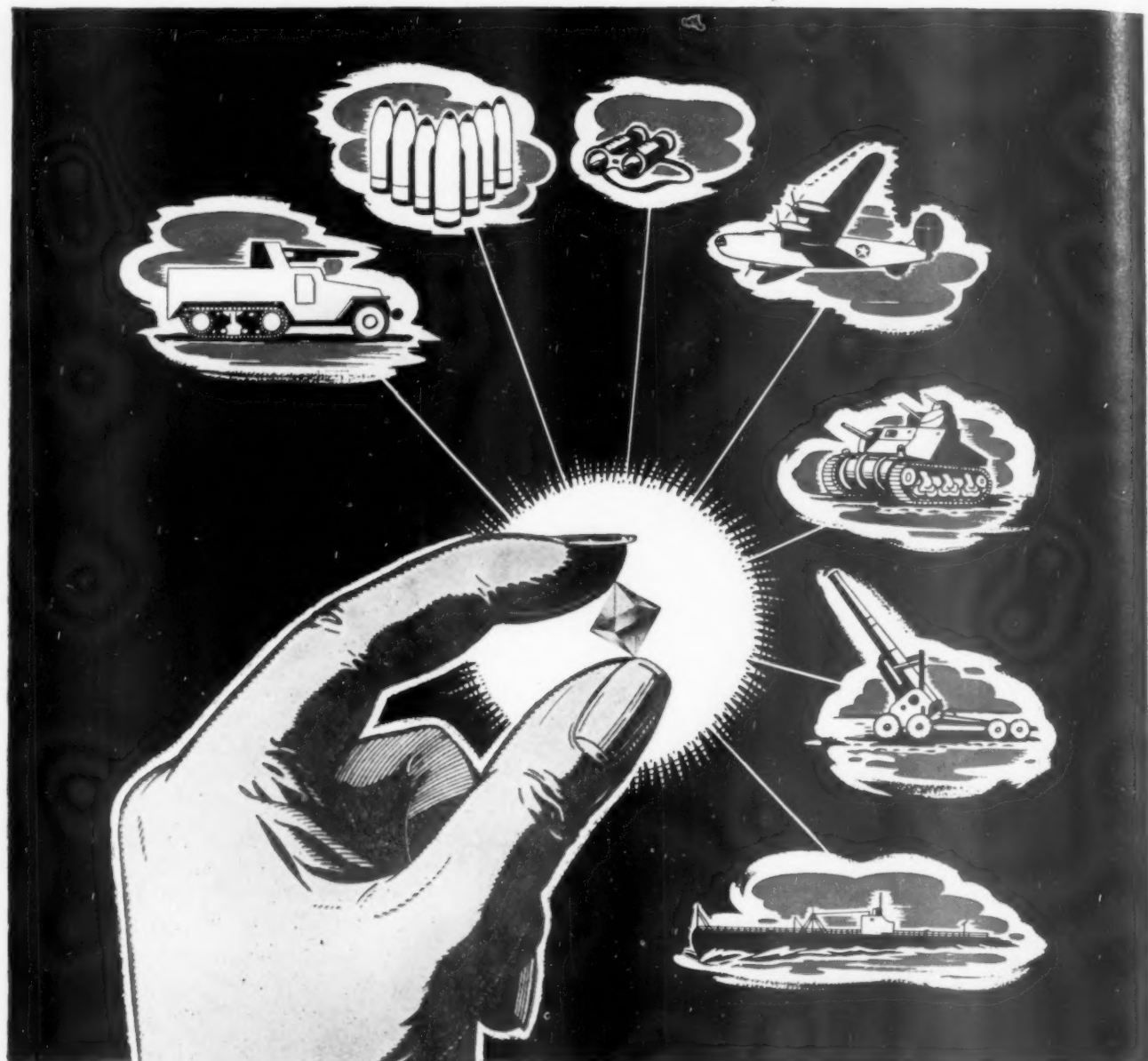


Write for the new Allison catalogue  
or SEE YOUR LOCAL DISTRIBUTOR.

## Allison

**TOOL AND ENGINEERING CO.**

4031 WHITTIER BLVD., LOS ANGELES 23, CALIF.



*Diamonds*

## WERE NEVER MORE PRECIOUS

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### WHEEL TRUEING TOOL COMPANY

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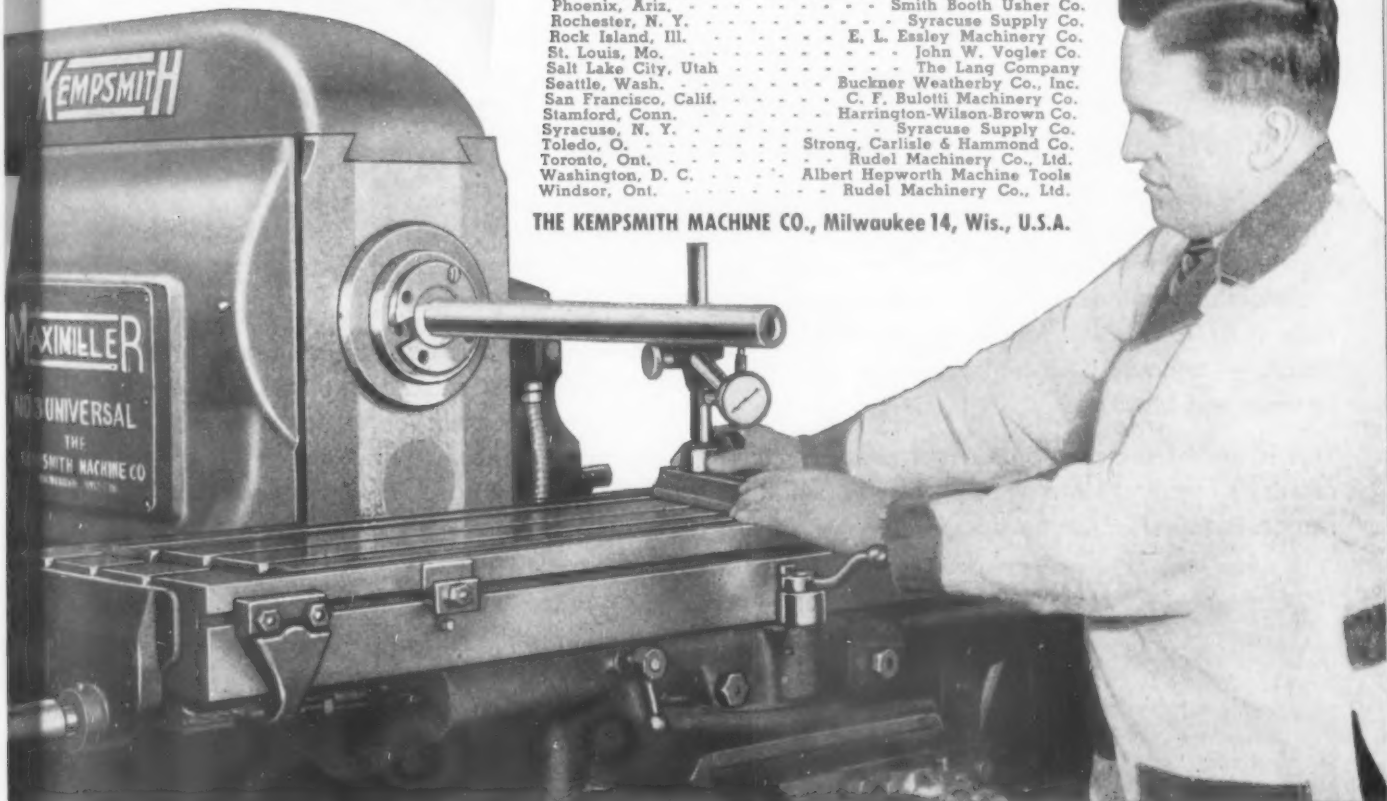
# "That KEMPSMITH Dealer Certainly Knows His Stuff"

"Whenever I have a machine tool servicing problem in my plant, I call in a Kempsmith distributor. I have the utmost confidence in him for he's as dependable as they make 'em. and certainly knows his stuff. Sure, I realize Kempsmith Milling Machines don't require much servicing, but at least it's a source of great satisfaction to know there's a distributor nearby who has both the ability and facilities to service all types of machine tools, should the occasion arise."

## Exclusive KEMPSMITH Distributors:

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Washington, D. C.	Albert Hepworth Machine Tools
Windsor, Ont.	Rudel Machinery Co., Ltd.

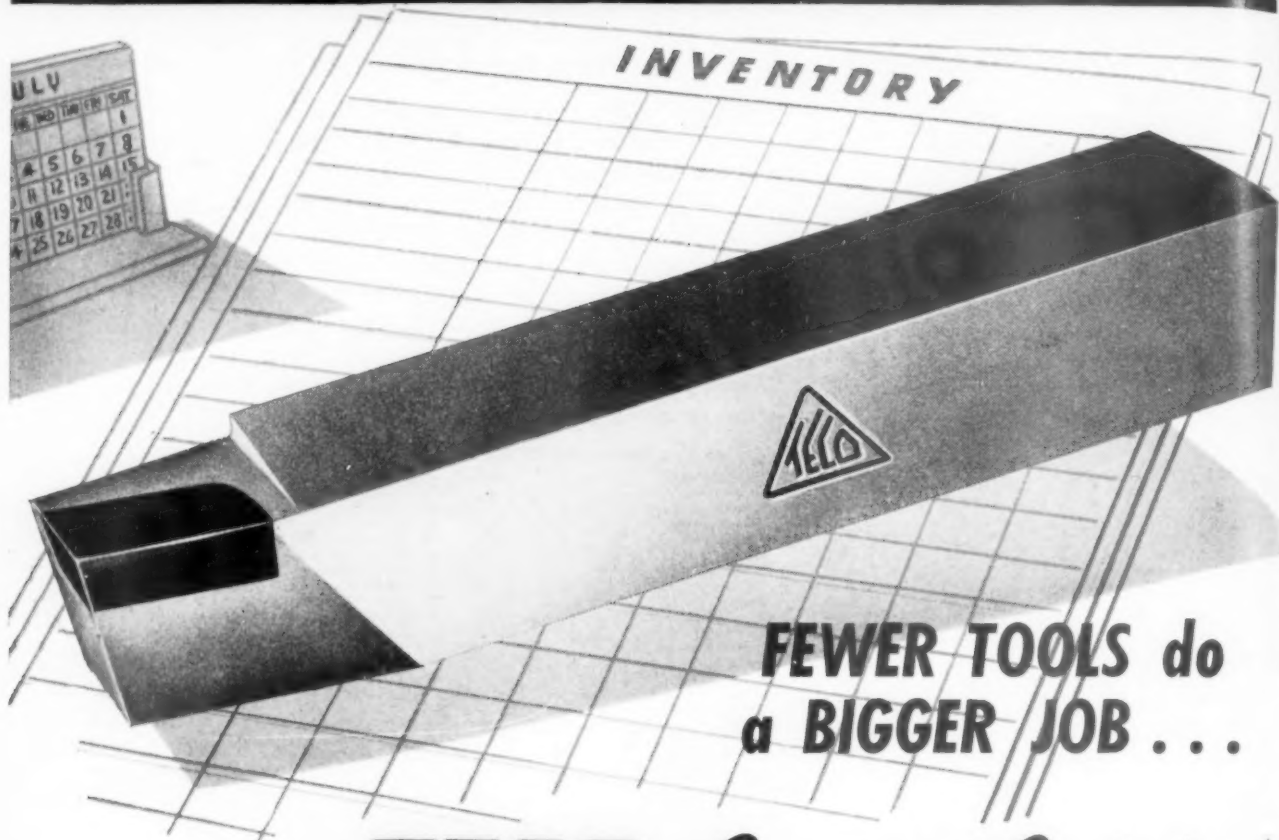
THE KEMPSMITH MACHINE CO., Milwaukee 14, Wis., U.S.A.



# KEMPSMITH

• Precision Built Milling Machines Since 1888 •

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**FEWER TOOLS do  
a BIGGER JOB . . .**

**when you use TECO *Cemented Carbide!***

There is so much more production in each TECO Cemented Carbide tool, you need fewer tools to maintain peak production. TECO Cemented Carbide stays on the job longer — produces more pieces — because it has extraordinary resistance to wear and breakage.

This is no mere claim, but a fact proved in the country's foremost metal-working plants. And the reason is found in the harder, denser, more uni-

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Conveniently located representatives are glad to show you how TECO Cemented Carbide can increase your production, at lower tool cost. Write for catalog and new price list covering tools and blanks in sizes, grades and styles for practically all machining needs.



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# TECO

Pioneers in Tungsten Carbides  
for over a Quarter Century



# CEMENTED CARBIDE

**E.** Every spot to be lubricated on each machine is marked with the code number of the lubricant required.

## ★ LUBRICATION ENGINEERING



of What You'll Find in  
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Cold Treating "Textbook"

SECTION I—INDUSTRIAL COLD TREATING AND HOW  
IT IS USED

How Deepfreeze Assisted in the Development  
of Cold Treating.  
How Deepfreeze Sub-Zero Temperatures Can  
Be Applied to Your Production.  
What the New Deepfreeze Process of Cold  
Treating Is.

SECTION II—DEEPFREEZE SUB-ZERO CHILLING EQUIP-  
MENT

SECTION III—HARDENING OF METALS

What Happens When Metal Is Cold Treated?  
At What Temperatures Must Metal Be Cold  
Treated?  
How Long Does It Take to Cold Treat Metal?  
Procedure in Calculating the Rate of Production.  
Common Cold Treating Procedures.

SECTION IV—STABILIZATION OF METALS

Stabilization of Metals by Cold Treating.  
Stabilization Procedures.  
Results of Stabilizing Gauges and Precision  
Machine Parts.

SECTION V—SHRINKING OF METALS

Shrinking of Metals by Cold Treating.  
Advantages of Chilling for Shrink-Fit Assembly.  
Procedure in Shrinking Metal.  
Results of Shrink-Fit Assembly by Cold Treating.

SECTION VI—TESTING AND MISCELLANEOUS APPLI-  
CATIONS

Testing of Aircraft Instruments and Materials at  
Sub-Zero Temperatures.  
Miscellaneous Applications.

SECTION VII—TECHNICAL DATA AND TABLES

Table for Conversion from Degrees Centigrade  
to Degrees Fahrenheit.  
Shrink-Fit Tolerance Table.  
Shrink-Fit Allowance Table.  
List of Deepfreeze Users.  
How to Use the Deepfreeze Technical Service.

*Cold Treating Practice*  
WITH **Deepfreeze**  
INDUSTRIAL SUB-ZERO  
CHILLING EQUIPMENT



*Released  
July 1*

THIS NEW 1944

# Deepfreeze

## COLD TREATING "TEXTBOOK"

● To bring you up-to-date on cold treating, Deepfreeze has just released a new "Cold Treating Practice" manual containing the latest authentic information on the use of sub-zero temperatures for the hardening, stabilization, shrinking, and testing of metals and other materials. This 40-page "textbook" contains the latest developments and practice finding widespread use today in the cold treatment of metals.

**This Free Book Will  
Show You How to  
Get the Advantages  
of Cold Treating  
in Your Plant**

Whether or not you are using sub-zero temperatures in your plant at present, you will be interested in the new procedures that have been developed. If you are now cold treating, you will be able to check your applications against those

listed—and many of these have been discovered only recently—to determine whether you are using it to full advantage.

Cold treating is on the move. Yesterday's literature no longer tells the complete story. The rapid progress made in this field since the publication of the first Deepfreeze Cold Treating Manual late in 1943 is of extreme importance to industrial users. To bring you the latest information, Deepfreeze presents this new working guide on the use of sub-zero temperatures.

This book reflects our pioneering experiences in the science of cold treating and the sound practical knowledge we have accumulated from metallurgists, heat treating experts, production men and Deepfreeze users. The material for this manual has been gathered by our staff of field engineers constantly reporting the applications of Deepfreeze sub-zero temperatures in industry.

**Contains Latest  
Authentic Data from  
Metallurgists,  
Production Men and  
Deepfreeze Users**

*Send coupon today for  
your free copies*

Every executive and production man concerned with the "conditioning" of metals should have a copy of this new book. Send the coupon today for the number of copies you need for your key men.

Deepfreeze

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Please send.....copies of the new 1944 Deepfreeze "Cold Treating Practice" book to:

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# Deepfreeze

TRADE MARK DEEPFREEZE REGISTERED UNITED STATES PATENT OFFICE  
Industrial Chilling Equipment for Shrinking, Testing, Hardening and Stabilizing Metals

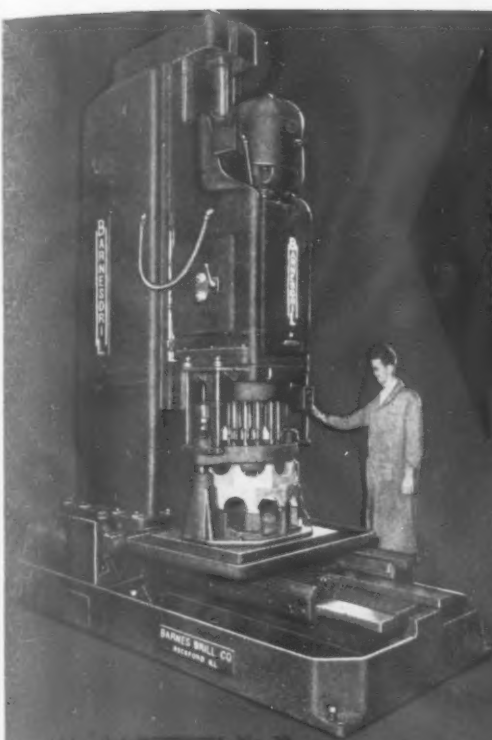
2311 DAVIS STREET  
NORTH CHICAGO, ILLINOIS



# How to Get Production Machines Like These for Your "Special" Drilling Operations

VERTICALLY

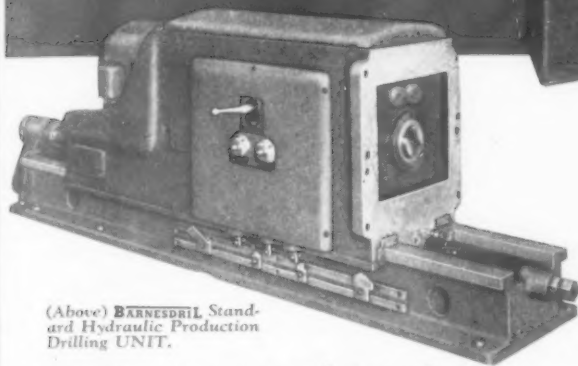
HORIZONTALLY



(Above) A BARNESDRIL No. 20 Standard Hydraulic UNIT is used vertically for drilling on aluminum aircraft parts.



(Left) Three BARNESDRIL UNIT



(Above) BARNESDRIL Standard Hydraulic Production Drilling UNIT.

## Can Be Arranged Vertically, Angularly, or Horizontally

These BARNESDRIL UNITS can be arranged in one, or any combination of vertical, horizontal or angular positions and an appreciable saving in machining and handling time is realized when the UNITS are grouped around an indexing table for progressive operations.

## Get Complete Facts In This New Bulletin

Complete details and specifications of these new BARNESDRIL UNITS are contained in a new bulletin, available now upon request. The bulletin explains how these machines, when adapted to your work, result in greater production at lower cost. Send for Bulletin T-150 today.



## With this "Standard" BARNESDRIL Hydraulic Drilling UNIT

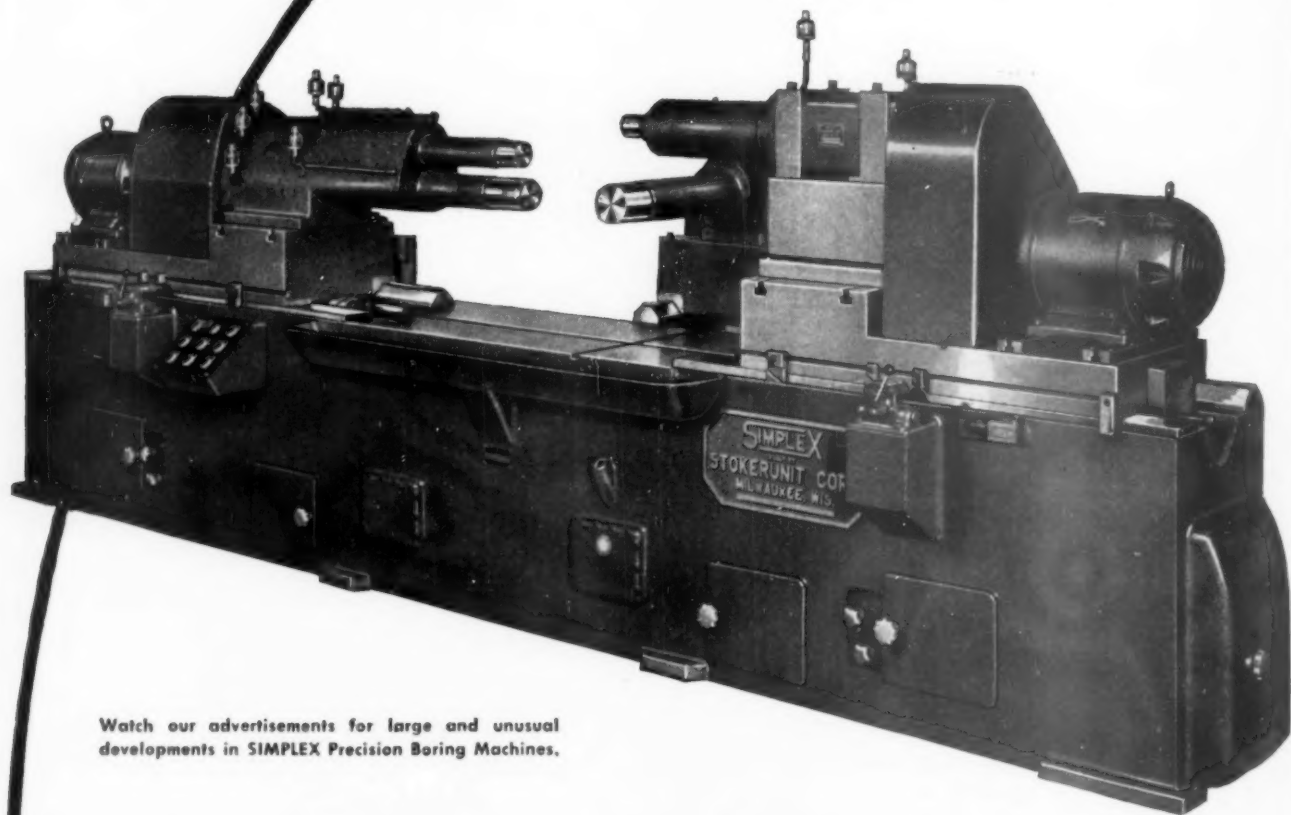
It is now possible to obtain maximum production at lowest cost on your "special" drilling work with BARNESDRIL Standard Hydraulic Production Drilling UNITS. Self-contained and complete in themselves, these UNITS can be furnished as high production drilling machines, by mounting on the proper columns, horizontal beds, supports and other elements. Three sizes, Nos. 5, 10 and 20, are available, each motorized according to the requirements of the job. The flange support of the UNIT allows mounting of interchangeable auxiliary heads with the required number and arrangement of spindles. Considerable savings have been effected in engineering and development costs by the use of standard UNITS in the construction of these machines.

**Barnes Drill Co.** 848-71 CHESTNUT STREET  
ROCKFORD ILLINOIS, U.S.A.

# SIMPLEX

When a leading tractor manufacturer contracted to build a transmission for a military tractor, they realized they could not take any chances with Government inspection. A SIMPLEX 3U 3-way Precision Boring Machine, large enough to bore a unit 4' long, made a quick and easy job of getting them out swiftly — and right!

The transmission case was approximately rectangular, 48" long, 19" wide and 21" high. There were six bores, ranging from 2¾" to 6½". Most of them were located so deep in the casting that extension type spindle heads were necessary. With this arrangement there was very little tool overhang, accuracy was easily maintained, tool life increased, chatter avoided.



Watch our advertisements for large and unusual developments in SIMPLEX Precision Boring Machines.

## Precision Boring Machines

### STOKERUNIT CORPORATION

SIMPLEX Precision Boring Machines and Planer Type Milling Machines

4528 West Mitchell Street, Milwaukee 14, Wisconsin

# Something New Has Been Added to HEIGHT GAGES

it's a —  
**Fine  
Adjustment  
and a FEDERAL  
TESTMASTER**



No more "tapping" is necessary when you set the Indicator to the gage blocks or master to the required measurement. The **fine adjustment** of the Indicator Bracket brings it into position positively and yet as lightly as a feather. The Bracket can be set anywhere on the upright.

## MODEL 1492

18" CAPACITY  
Complete with —  
FEDERAL

Testmaster No. 1, \$55.50  
or  
Testmaster No. 2, \$60.00

You get all three with the Model 1492, the Federal Testmaster Indicator, the Fine Adjustment Bracket and the 18" Stand, in a handsome wooden case. You will find it is more convenient, more precise and requires no figuring. Just set to gage blocks or master and check. Write for further details to —

## FEDERAL PRODUCTS CORP.

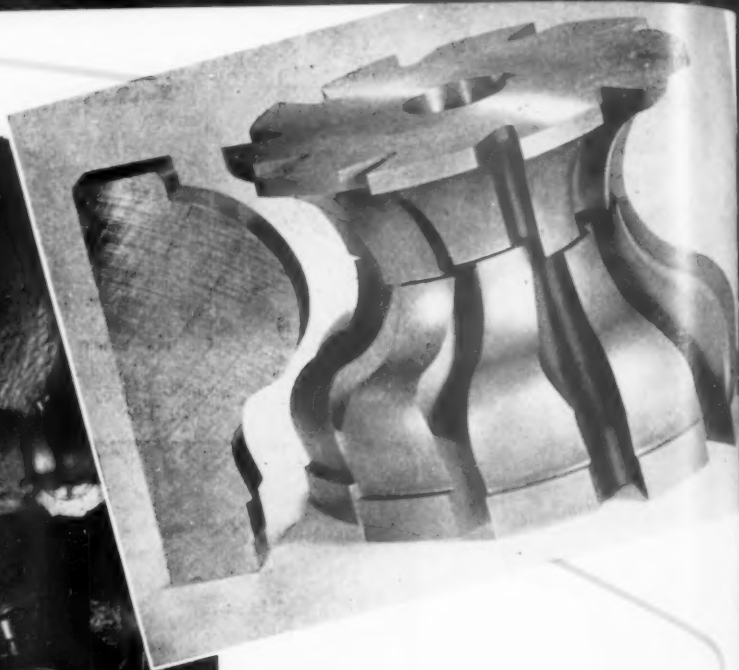
1144 EDDY STREET, PROVIDENCE 1, RHODE ISLAND

You can set the Testmaster Indicator at any angle — down in a hole, sidewise, or close up to the bracket.

# FEDERAL

PRECISION MEASURING INSTRUMENTS

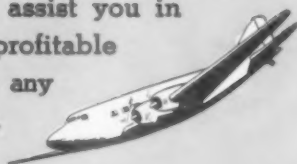




## EXPERIENCE... THE ESSENTIAL INGREDIENT IN FORM CUTTERS!

Every profile milling job has its own peculiar features, as different from plain milling as a curve is different from a straight line. Experience, not formula, furnishes the answer to the problems presented by such special applications.

From their years of close contact with leading metal working companies, Illinois Tool Engineers offer you the advantage of a vast experience in all methods of metal cutting. They can assist you in making the most efficient and profitable use of form relieved cutters or any other proven milling technique.



OVERNIGHT TO ALL AMERICA ... FROM THE HUB OF AIR TRANSPORTATION

# ILLINOIS TOOL WORKS

2501 N. KEELER AVE. CHICAGO 39, ILLINOIS  
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario



MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

### ILLINOIS

PRECISION METAL  
CUTTING TOOLS



Ground Hobs



Shaper  
Cutters



Milling  
Cutters



Ground Form Tools



Broaches

Special Tools... Gear Measuring Machines...  
Gear Measuring Blocks... Die Filing Machines



# Now 5

## GRINDING SPINDLES FOR MAXIMUM OUTPUT

THE NEW  
HANCHETT  
NO. 100  
SURFACE  
GRINDER



A high-speed, large-capacity, precision machine, designed to meet your present and future production plans. Takes five cuts — from rough to precision grinding in one pass — with automatic worksize control. Has 200 hp in grinding heads — five 40 hp motors, each driving 20" segmental wheel. Table is 100" in diameter, 20" wide. Approximate weight, 55,000 pounds. Your inquiries are invited.

WRITE  
TODAY  
for  
BULLETIN  
No. 144-4



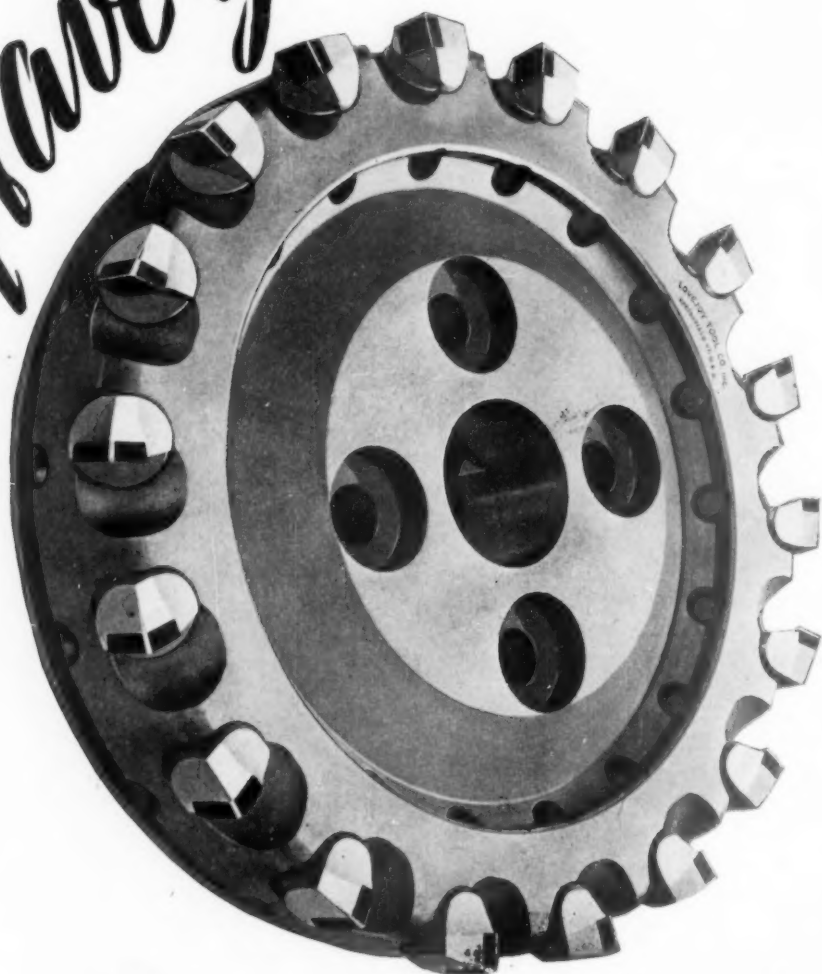
IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

**HANCHETT MANUFACTURING CO.**  
BIG RAPIDS MICHIGAN U.S.A.

*Have you seen*

THE TYPE  
"H"

FACE  
MILLING  
CUTTER



*It's new — it's husky — it's a Lovejoy*

The new Lovejoy Type "H" face mill is designed for  $\frac{3}{4}$ " depth of cut. This cutter is available in diameters from 6 to 18 inches—every size has one-inch blades—every one has a husky, forged steel body! Note the proportion of the blades and the generous chip clearance. Note how well those carbide tips are backed up with plenty of steel.

The Type "H" has the famous Lovejoy positive-locking device to hold the blades immovable, even on heavy intermittent cuts.

Like the rest of the Lovejoy line, all blades are machined for interchangeability, and all blades are interchangeable throughout the complete range of sizes. Blades of HSS, cast alloy or cemented carbide can be furnished.

The Type "H" design has been standardized from diameters of 9" to 18" inclusive, for mounting to the No. 50 National Standard Spindle, as shown in the photo. The diameters 6" to 9" are furnished for Shell End Arbor mountings. For further information, write to Lovejoy today.

**LOVEJOY** TOOL COMPANY, Inc., Springfield, Vermont

MILLING  
CUTTERS

SINGLE POINT  
TOOLS

BORING  
HEADS

BORING  
BARS

SPOT FACING  
TOOLS

TURRET  
TOOL POSTS

COUNTERBORES

# ROYAL PURPLE

## DIAL INDICATOR CONTACT POINTS TIPPED WITH NORBIDE



The standard line of Norbide (boron carbide) dial indicator contact points, made by New England, is now identified by the **ROYAL PURPLE** shank. This serves a triple purpose—no longer can you confuse tungsten carbide\* or diamond\*\* with Norbide tips—it assures you of New England quality—the color is actually a rust-proof finish.

As for the boron carbide tip—it is non-metallic, therefore it cannot charge—it **will not scratch the work**—it has a perfect mirror finish—thousands of in-

stallations have proved that it is the ideal tipping material because of the above reasons and its tremendously long life with resultant economy.

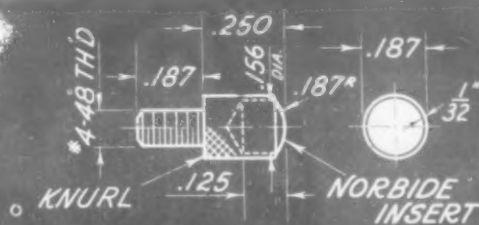
New England Carbide Tool Company's wide experience in fabricating boron carbide has resulted in manufacturing savings that are passed on to you. The prices listed below are low, but New England quality is guaranteed. We will be pleased to quote on special boron carbide tipped contact points, anvils and wear parts—just send detailed prints and quantities required.

\*Identified by **GREEN** shank.

\*\*Identified by **BLACK** shank.



**NEW ENGLAND CARBIDE TOOL CO., Inc.**  
60 Brookline St., Cambridge 39, Massachusetts



LIST PRICE **\$7.50** EA.

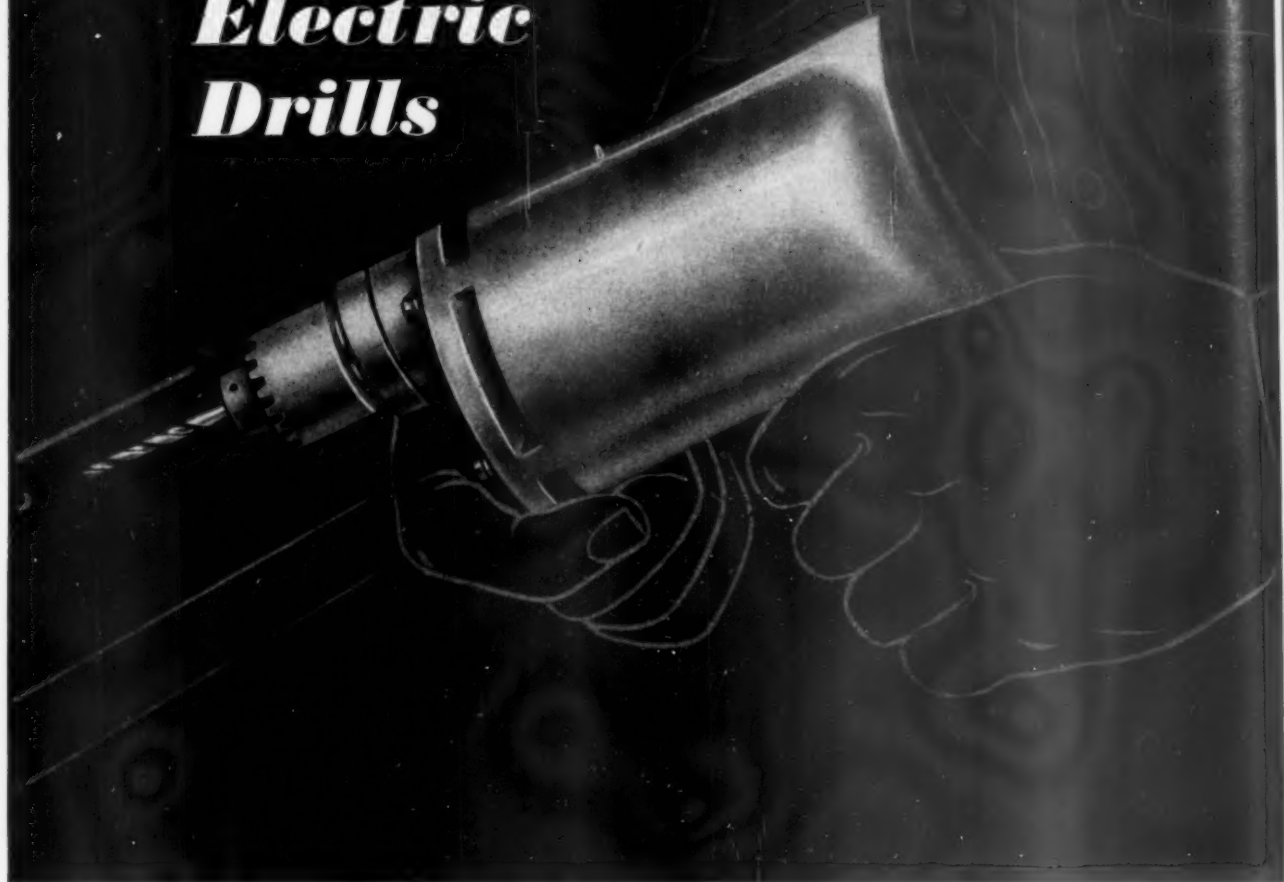
Number	Discount	Price
1-5	List	\$7.50 ea.
6-11	List Less 10%	6.75 "
12-49	" " 20%	6.00 "
50 or more	" " 33 1/3%	5.00 "







## ***Universal Electric Drills***



### ***Designed for the Production Line***

CP Universal Electric Tools are built to "take it" — with powerful, high torque trouble-free motors. "Straight-Line Airflow" ventilation makes the motors particularly cool running. Heat treated helical gears and ball bearings throughout make CP Universal Electric Tools silent as well as enduring. Every feature of their design is calculated to meet long continuous service — *truly production line tools.*

The drill illustrated is the CP No. 806 "Midget" — ideal for close quarter drilling jobs up to  $\frac{1}{4}$ ".

In addition to Drills, CP Universal Electric Tools include — a long line of Reamers, Tappers, Screw Drivers, Nut Runners, Grinders, Sanders, Buffers, Flue Rollers, Hammer Drills, Scalars, Files. For complete information, write for Catalog No. 899.

★ ★ ★ ★ ★ ★ ★ ★

PNEUMATIC TOOLS  
ELECTRIC TOOLS  
(Nicycle...Universal)  
ROCK DRILLS

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TOOL  COMPANY

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AIR COMPRESSORS  
VACUUM PUMPS  
DIESEL ENGINES  
AVIATION ACCESSORIES



# THE FIRST 25 YEARS



## From 1919 to 1944 - a QUARTER CENTURY of ENGINEERING and PRODUCTION ACHIEVEMENT

Solving difficult production problems for American industry has been the business of Ex-Cell-O since its inception twenty-five years ago. Often this has entailed the development of special purpose machines for single and multiple operations . . . to do work faster, more economically, and with a much higher degree of accuracy. Where the quantities have justified it, Ex-Cell-O has not only designed and built special machines to produce parts of improved quality but has undertaken actual production and assembly of these parts in its own plant, using to practical advantage Ex-Cell-O's complete heat treat equipment and widely-experienced production staff.

The days ahead . . . both war and postwar . . . are likely to offer a multitude of opportunities for the kind of engineering and production assistance that Ex-Cell-O can give so well. Consequently, the suggestion is made that, insofar as is practicable, your planning be started early. Ex-Cell-O's extensive facilities are at your disposal. Write to Ex-Cell-O in Detroit today.

### EX-CELL-O CORPORATION • DETROIT

An Ex-Cell-O 25th Anniversary Book, illustrated above, has just been printed. If you would like a copy just write to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.

#### Ex-Cell-O "Firsts"

*EX-CELL-O was the first company in the United States to design and manufacture and introduce for successful commercial use...*

- ... precision ball bearing internal grinding spindle
- ... horizontal-type precision boring machine
- ... precision thread grinding machine
- ... precision cylinder honing machine
- ... 1 1/2 horsepower compact hydraulic power unit
- ... Diesel fuel injection pump and a universal-type Diesel engine nozzle
- ... machine to form and fill automatically square paper milk bottles in the dairy

*EX-CELL-O was also the first American company to undertake the mass production of hardened and ground precision parts for aircraft engines.*

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH GRINDING MACHINES • HYDRAULIC POWER UNITS GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PURE-PAK MILK CONTAINER MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

# Thor BANTAM ROTARY AIR GRINDERS

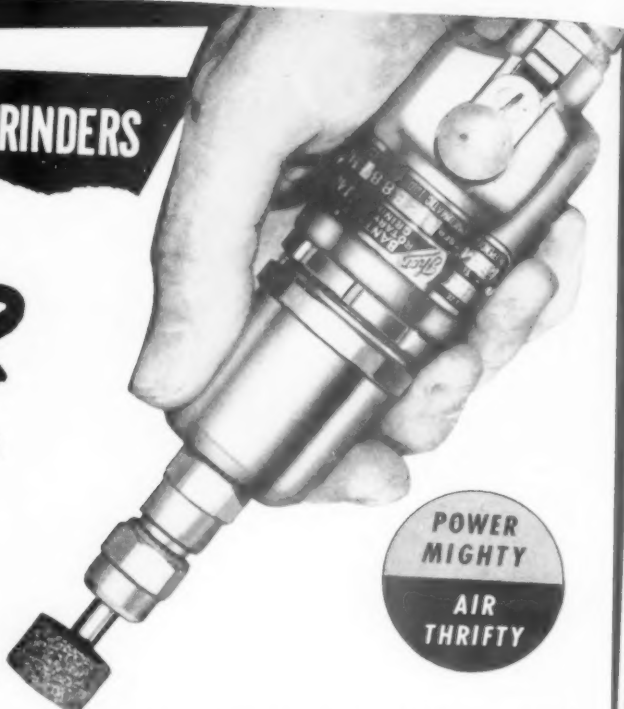
## A HANDFUL OF POWER FOR HUNDREDS OF JOBS

### For All Small-Wheel Work

The new Thor "Bantam" Rotary Air Grinders are the ideal small-wheel grinders for shop, laboratory, or work bench. They handle all accessories; work in practically every material. Have the right speeds and power for grinding with abrasive wheels and points; for cutting with rotary files; routing with steel cutters; polishing with felt and soft rubber polishers; cleaning with wire brushes; and for sanding.

### SMALL • LIGHT • POWERFUL

The small size and light weight of Thor "Bantam" Rotary Air Grinders provide perfect one-hand operation. They handle easily as a pencil for



**POWER  
MIGHTY  
AIR  
THRIFTY**

accuracy on precision work; yet their power and sturdy construction assure continuous and efficient performance on hard jobs.

Thor Rotary Air Grinders of the "Bantam" type are available in speeds from 7,000 to 21,000 R.P.M.; in weights from 20 ounces to 5 1/16 pounds; in lengths from 6 3/8 inches to 15 inches.



#### • SMALL-WHEEL GRINDING

Mounted abrasive points and wheels up to 2" diameter can be used in Thor "Bantam" type Air Grinders. Wheels are available in a wide range of sizes and grains for grinding all materials. Designed to fit the hand, the Thor "Bantams" provide perfect control, "finger-point" accuracy and dependable power for hundreds of jobs.



#### • CUTTING AND ENGRAVING

Because the Thor "Bantams" handle as easily as a pencil they are ideal for use with rotary files and steel cutters. Precision cutting, carving, beveling, routing and roughing in wood, plastics and metals is done rapidly and efficiently in minutes where formerly hours were required.



#### • POLISHING AND BUFFING

Superlative finishes on practically all materials are obtained by Thor "Bantams" when used with soft felt and soft rubber wheels. Hours of hard labor are saved and finer results are obtained with these fast, convenient tools.



#### • CLEANING AND SANDING

Cleaning, removing rust, and many other wire brush jobs are done faster and better with versatile Thor "Bantams."

Sanding discs and drum sanders used with Thor "Bantams" for use on wood or metal save much handwork.

Steel saws and rubber cutting discs for high speed operation with Thor "Bantams" cut light materials with lightning speed.

### THOR AIR GRINDERS OFFER THESE ADVANTAGES

**"Finger-Point" Accuracy**—Thor "Bantam" Grinders fit perfectly in one hand . . . handle as easily as a pencil . . . provide "finger-point" accuracy.

**Dependable Power**—Thor one-piece rotor is perfectly balanced to revolve without vibration. Multiple blade construction insures quick action and instant starting under load.

**Longer Life**—Alloy-steel housings are die-cast for strength and long-lasting, continuous service.

These, and such other features as automatic lubrication, positive-lock of throttle for assured continuous operation and on some models, free rotation into any position with a swivel hose connection, are available in the complete line of Thor "Bantam" Type Air Grinders.



000H GRINDER



000 GRINDER



10 GRINDER

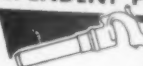
	000H	000	00D	00H	10-18	10-15	10-10
WHEEL (Vitrified) CAP. (Bonded)	1 1/4" x 1/2"	1 1/2" x 1/2"	1 1/4" x 1/2" 1 1/2" x 1/2"	1 1/2" x 1/2" 2" x 1/2"	1 1/2" x 1/2" 2" x 1/2"	1 1/2" x 1/2" 2" x 1/2"	2" x 1/2" 3" x 1/2"
SPEED (r.p.m.)	20,000	14,000	21,000	17,000	18,000	15,000	10,500
WEIGHT	22 ozs.	20 ozs.	3-3/16 lbs.	5-1/16 lbs.	4 3/8 lbs.	4 3/8 lbs.	4 3/8 lbs.
LENGTH	6 3/8"	6 1/8"	9 1/2"	13 3/8"	15"	15"	15"

Learn today how Thor "Bantam" Air Grinders can save you time and money on hundreds of jobs. Write for Thor Catalog 52-B.

**Thor**

Portable Pneumatic and Electric Tools

**INDEPENDENT PNEUMATIC TOOL COMPANY**



600 W. JACKSON BOULEVARD CHICAGO 6, ILL.  
Branches in Principal Cities

THE TOOL ENGINEER

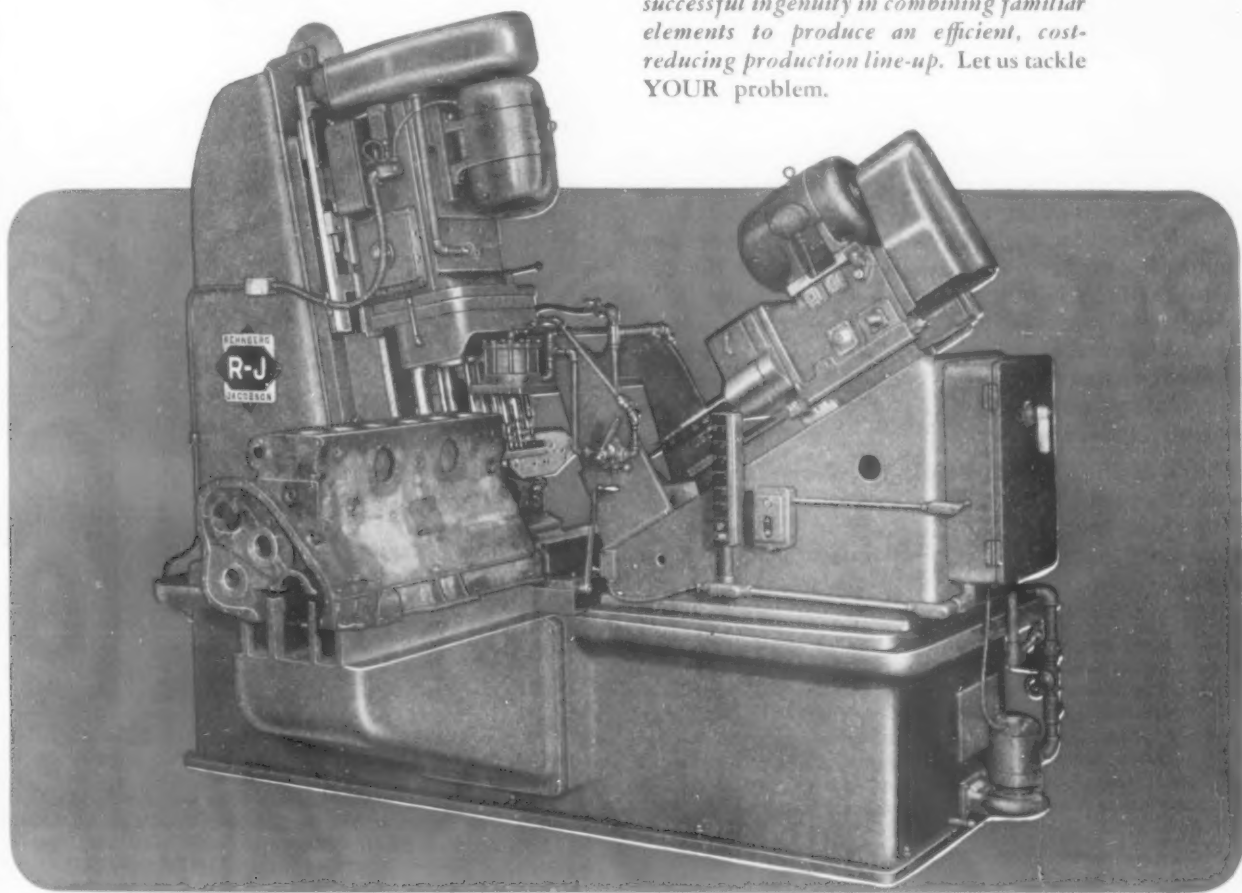
# Rehnberg-Jacobson

## ENGINE BLOCK DRILLING MACHINE

**DRILLS 27 HOLES, ALL ANGULAR, ONE OF WHICH IS ELEVEN INCHES DEEP**

This machine was specially designed to fit into the production line of a new model six-cylinder heavy-duty truck engine block. It drills all the holes in the four angular pads on both sides of the block. One of these holes is eleven inches deep. The block is slid into the machine on rails and clamped with two air cylinders. Three W. F. & John Barnes units, with multiple drilling heads of our design and manufac-

ture, are set on angular bedways. Each operates on an individual and self-controlled cycle to finish the holes in proper sequence and avoid interferences. A companion machine, equipped with Rehnberg Tap Units, taps certain of the drilled holes. A rotating circular transfer table between the two machines enables the operator to burr all the drilled holes with an electric hand drill. *This is a good example of our successful ingenuity in combining familiar elements to produce an efficient, cost-reducing production line-up.* Let us tackle YOUR problem.



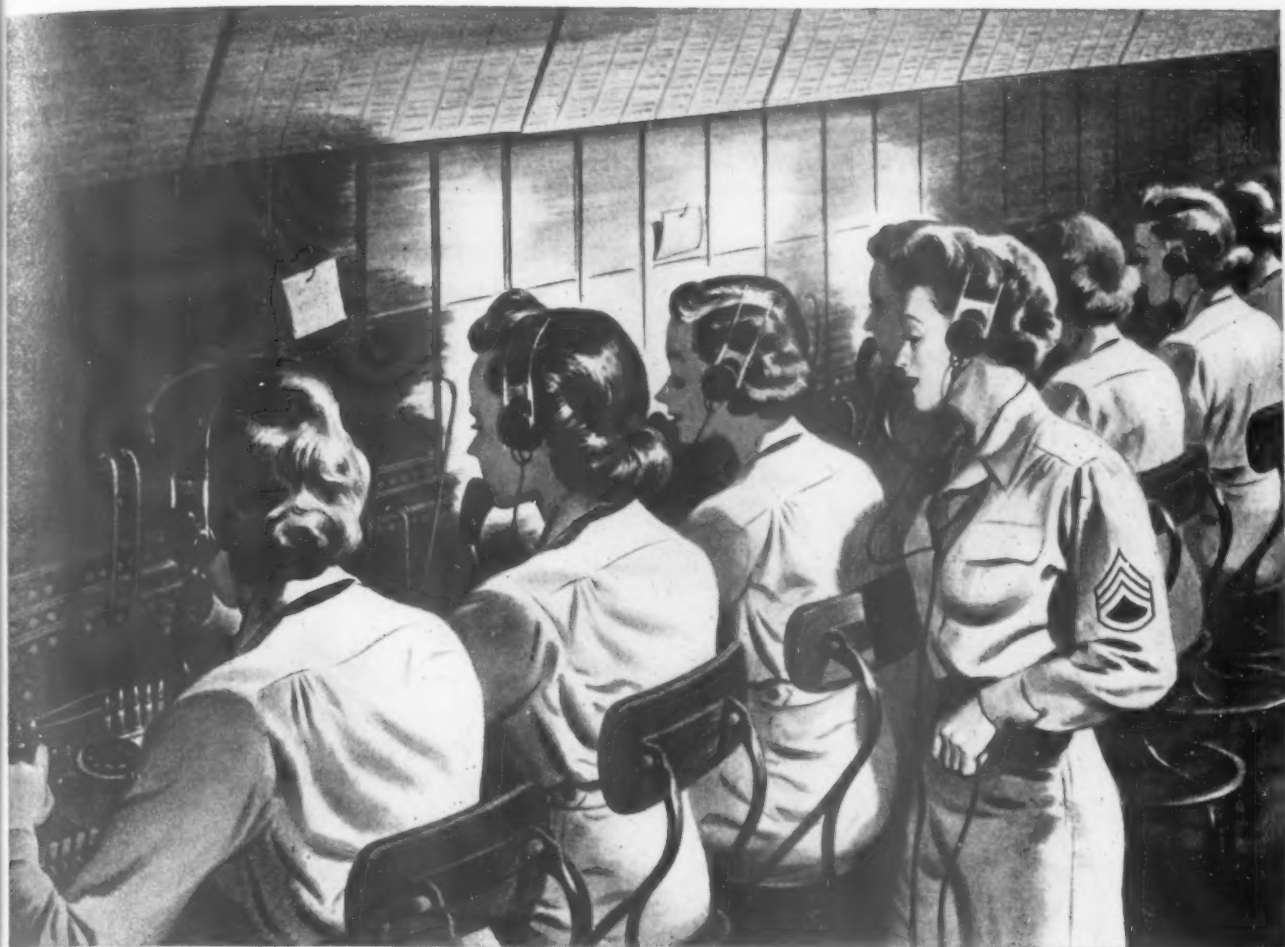
**REHNBERG-JACOBSON MANUFACTURING CO.**  
*Special Machinery*

**2137 KISHWAUKEE ST. ROCKFORD, ILLINOIS**









## NICKEL AIDS THE COMMUNICATIONS INDUSTRY

### *to KEEP 'EM IN TOUCH!*

In the tradition of Morse and Bell and Marconi, the communications engineer carries on today.

His work, always valuable, now is vital.

No military campaign proceeds without it. The close teamwork between air, ground, and sea arms is possible only through instruments and equipment that keep them in touch though scattered throughout the four quarters of the globe.

And the vastly increased pace of modern war production brings with it increased use of every home-front circuit, line and wave-length.

All branches of the communications industry... telephone, telegraph, radio... are meeting the tremendous demand for their products. In war, communication engineers are taking advantage of their long peacetime experience with metals and alloys.

Time and time again this experience has shown them that a little Nickel goes a long way in improving other metals.

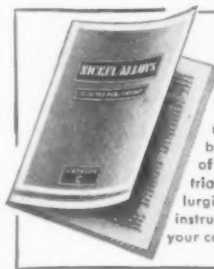
So now, when the dependability of what this industry makes is of supreme importance to the Nation, it favors more than ever the use of Nickel.

In repeaters, relays, magnetos, loading coils, transformers, loud-speakers and modern cables... even in the molds that form plastic radio parts... they call upon Nickel and its alloys for several unique advantages.

When other metals lack toughness, Nickel often supplies it. When they lack strength and fatigue resistance or corrode too easily, adding Nickel provides the needed qualities. Under abrasion, wear, shock and stress metals perform better with Nickel than without.

In the communications industry, as in many another, the knowledge, experi-

ence and cooperation of our staff has been at the disposal of technical men. Whatever your industry may be... if you want help in the selection, fabrication, and heat treatment of alloys... similar counsel and data are at your service.



#### Catalog "C"

makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ **Nickel** ★

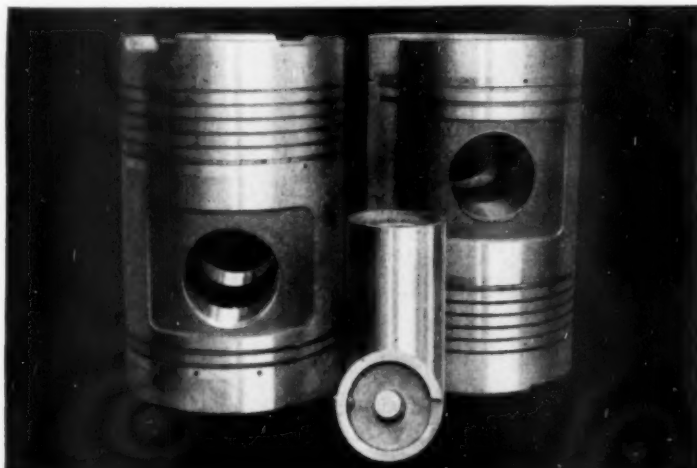
**THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.**

JULY, 1944

# PISTON PRODUCTION INCREASED

AT DIESEL ENGINE PLANT

# 125%



*Diesel pistons before and after boring operations. (See tooling — operations below.)*



*W. F. and John Barnes Duplex Piston Boring Machine.*

## TOOLING AND OPERATIONS

**1st OPERATION**—Rough bore 2 diameters from both sides (diameters 4.985" and 5.113").

**2nd OPERATION**—Finish bore 2 diameters from both sides (diameters 5.000"  $\pm .001$ " and 5.128"  $\pm .001$ ". —.000"

**TOOLING**—Special sleeve or shell type boring tools with two diametrically opposed carbide tools for each diameter.

**WORK MATERIAL**—Aluminum alloy casting (#302 ALW).

**CUTTING MATERIAL**—Carbonyl #44-A.

**COOLANT**—Kerosene.

**SPINDLE SPEED**—194 R.P.M.

**FEED**—.008".

**WORKING STROKE**—4½".

**TOTAL STROKE**—26".



*Special sleeve or shell type boring tools are used. Workpiece held in saddle type fixture.*

## 2 HOLES ROUGH AND FINISH BORED AND COUNTERBORED WITH W. F. AND JOHN BARNES MACHINE

Boring time was reduced by more than one-half when this large W. F. and John Barnes duplex boring machine was put into production at a locomotive plant manufacturing 6-cylinder diesel engines. The previous method required 45 minutes per piece. Floor-to-floor time is now only 20 minutes, of which 15 minutes are consumed in loading, unloading and tool changing.

To bore and counterbore the two piston pin holes simultaneously, the machine has two opposing spindles and is made with two sliding head self-contained hydraulic units. Each diameter is bored by two diametrically opposed carbide tools. Special sleeve or shell type boring tools are used, fitting the arbors in the work spindles and locked by collar and screw. The workpiece is held in a saddle-type fixture.

## SEND US YOUR PRODUCTION PROBLEMS

At no obligation, our engineers will analyze your requirements and suggest a machine to fill them. W. F. and John Barnes have solved machining problems for makers of products ranging from pencil sharpeners to artillery gun barrels and locomotive parts. Our equipment is large enough to machine long, heavy beds and other large machine parts — our assembly capacity can handle any machine, regardless of size. Let us make specific recommendations for your latest problem, large or small.

# FREE

These useful booklets show how W. F. and John Barnes machines are designed to meet specific requirements. Boring, drilling, reaming, tapping and milling operations can be done simultaneously. Each booklet may suggest a tooling or production set-up you can use today. Write now — ask for Bulletin 744B



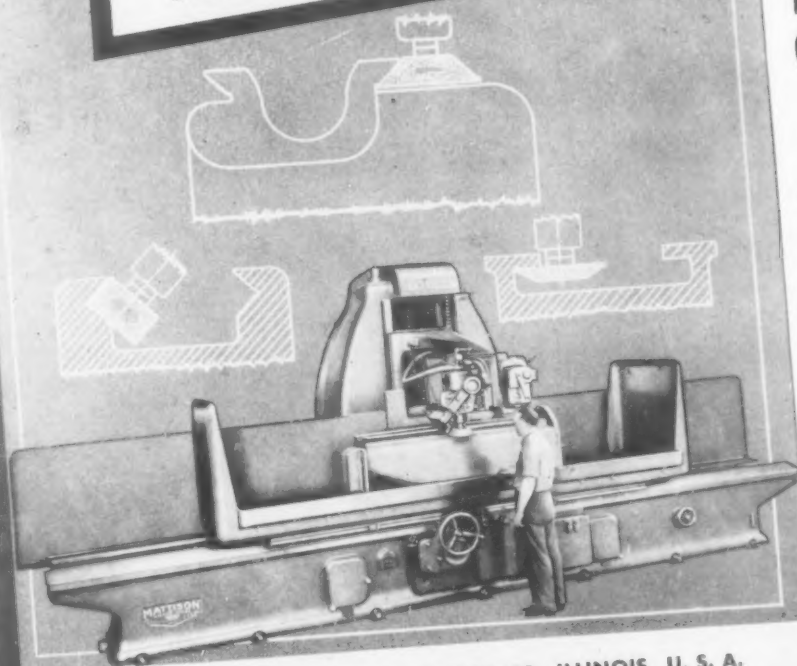
# W. F. and JOHN BARNES

325 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

# A NEW MATTISON GRINDER

## *for Finishing*

### **MATTISON** PRECISION VERTICAL-SPINDLE **WAY GRINDER**



MATTISON MACHINE WORKS, ROCKFORD, ILLINOIS, U. S. A.

**TABLES — SLIDES —  
SADDLES — HEADS —  
TURRETS AND  
OTHER PARTS  
HAVING ANGULAR  
MACHINED WAYS  
OR SURFACES —**

***Eliminates Costly  
Hand Scraping  
Operation . . .  
Permits Grinding  
Parts Having  
Hardened Ways  
to Closest  
Accuracy and  
Fine Finish . . .***

**SEND FOR NEW FREE CIRCULAR . . .**

## **MATTISON**

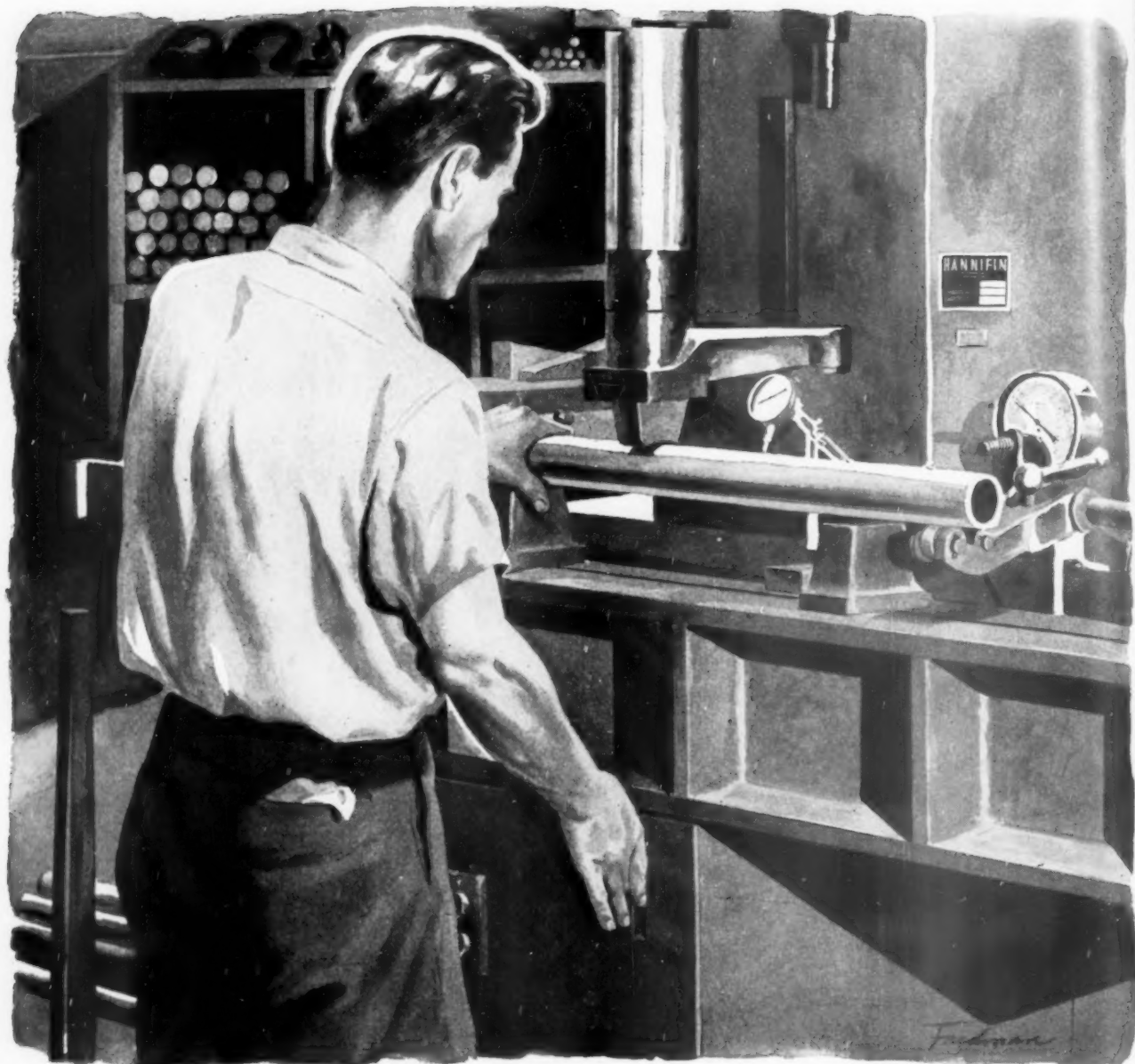
## **MACHINE WORKS**

**ROCKFORD • ILLINOIS**

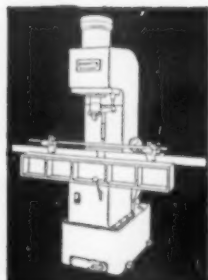
Mattison Machine Works, Rockford, Illinois  
Please send FREE Circular on new Mattison Vertical-  
Spindle Way Grinder.

Name \_\_\_\_\_ Title \_\_\_\_\_  
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## Easy straightening is faster



Hannifin 20-ton hydraulic press at a plant of The National Acme Company.

Straightening with a hydraulic press is merely applying the right amount of pressure at the right place. If an operator could exert a few tons pressure with his fingers, and had a supporting fixture to hold the piece, straightening would be easy.

Hannifin sensitive pressure control makes it just that easy. Ram pressure is proportional to control lever movement. Control is so easy, so natural that operators consistently turn out fast, accurate straightening—right the first time.

This press is but one example of Hannifin installations in the plants of producers of machine tools, aircraft, military vehicles, and armament.

Hannifin hydraulic presses are built in a full range of standard types, 5 tons to 150 tons, for straightening, forming, press assembly, and similar operations. Write for descriptive bulletins, or consult Hannifin engineers for specific recommendations. Hannifin Manufacturing Company, 621-631 South Kolmar Avenue, Chicago 24, Illinois.



# Hannifin

HYDRAULIC PRESSES

THE TOOL ENGINEER



# PRODUCTION PERSPECTIVES

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

**PRODUCTION PICTURE:** "D" Day has come and gone and reconversion still awaits substantial cutbacks. The fact that return to civilian output must await European "V" Day is beginning to dawn on labor and industry. Even then, Government plans call for only a 35 per cent reduction in U.S. war production.

**TODAY'S JOB:** Though output of "must" military items is near schedule, the overall production picture remains gloomy. To offset recent declines in all categories and to meet future schedules, production must jump 10 per cent during the next 6 months. Figures show April munitions output down 2 per cent from March. Unofficial reports place May output at November, 1943, level.

**TROUBLES:** Experts trace production slumps to various phases of the manpower problem—spot layoffs, the cutback psychology, absenteeism, strikes, industrial accidents, and short labor supply....Manpower is expected to reach its most critical stage in the fall. WPB is gambling on a summer victory.

**TRENDS:** Following the cutback of 1944's aircraft goal from 110,000 to 100,000 planes, 50-caliber machine guns have been cut back 10 to 15 per cent. Less efficient producers took cutbacks as high as 40 per cent....Tank and heavy truck output will rise again, with the auto industry shouldering both programs....Contrary to all predictions, ship output remains at near-peak levels.

**AIRCRAFT:** America's most dramatic production program is over the "hump". May output represented an all-time peak in terms of weight — 104,000,000 pounds, 2 per cent ahead of schedule. The 8,902 planes produced included more than 1,000 heavy bombers....No increase in manpower is needed or expected.

**PRODUCTIVITY:** Success in aircraft is a credit to mass production tooling.... Despite employment decrease of 9 per cent in the past 6 months, output of planes by weight has risen 29 per cent....Women constitute 39 per cent of all workers in the airframe industry, now turning out a plane every 5 minutes.

**WONDER PLANT:** Henry Ford's much maligned Willow Run has proved itself, is now producing a bomber an hour. More than one-half the 5,000 Ford-built B-24s produced to date have been turned out since January, 1944. Willow Run now employs 30,000 workers, 12,000 fewer than a year ago.

**MATERIALS:** Copper and steel remain the most critical metals. Don't look for early civilian production requiring much of either....Alcoa claims twice the compressive yield strength of common structural steel for its new 75s aluminum. Alloying elements totaling 10 per cent are said to be zinc and magnesium.

**FUTURE USES:** The auto industry, aluminum's best untapped postwar potential market, is giving light-metal makers the cold shoulder. Automen say the cost is 4 times too much for benefits to be derived....Steelmen are looking for new peacetime markets. From today's 90 million ton annual output, they visualize a postwar slump to 65 to 75 million tons annually in good years.

**RE-TOOLING:** WPB Chairman Nelson's action loosening the straight jacket on civilian production planning may not hasten the reappearance of prewar models. The new rules will cut months from scheduled dates for eventual introduction of "improved" designs. Note that power to OK reconversion plans goes to local WPB offices.

**SIGNIFICANCE:** More important than permission to build one experimental model was WPB's approval for manufacturers to (1) buy existing surpluses, (2) place orders for Government machines now in use in their plants, and (3) place orders with machine tool builders for equipment needed for civilian production.

## LAST-MINUTE NEWS REVIEW OF MASS MANUFACTURING



## FROM OUR CATALOG OF 1875

This quaint wood cut was reproduced from the pages of the 1875 catalog of the Wiley & Russell Manufacturing Company, one of the parent companies of the Greenfield Tap & Die Corporation. It shows the "finest threading tools" of that time and the copy modestly states "it is warranted to do five times the work that can be done in the old way."





Flush pin checking fixture determines tolerance simultaneously on 20 different surfaces. Such fixtures have eliminated hand gaging operations on large milled or turned parts produced by Nash-Kelvinator plants. Gaging boards, which reduce necessary hand operations, are shown at side.

# GAGE CONTROL

## Cuts Production Costs

**S**AVINGS ESTIMATED to total thousands of man-hours and thousands of dollars monthly are being effected through use of a new system of gage control on machining and assembly inspection in the plants of the Nash-Kelvinator Corporation.

Designed to relieve the machine operator or inspector of any responsibility for the accuracy of the gages he or she is using, as well as conserve time by eliminating the necessity of them visiting tool cribs during or at the end of shifts, this system throws the entire responsibility of gage control onto a Gage Inspection Department which operates as a unit of the plant Inspection Department.

This system, along with other time-saving developments, has been an im-

### WALLACE A. SCOTTEN

ASSOCIATE EDITOR

portant factor in the establishment of outstanding production records on aircraft engine manufacture in the Corporation's Kenosha, Wisconsin, and Milwaukee plants.

Formerly, the scene of final assembly for all Nash automobiles, the Kenosha plant has been converted 100 per cent to aircraft engine production. Today, the big plant bears no resemblance to its pre-war appearance. Every square foot of floor space used in automobile manufacture is devoted to parts manufacture and final assembly of 2,000 horsepower supercharged Pratt & Whitney radial engines used in Navy planes.

Likewise, the corporation's big Seaman Body Plant, in Milwaukee, peacetime producer of auto bodies for Nash, is today one huge machine shop handling magnesium castings.

This engine is comprised of approximately 12,500 separate pieces. The majority of the parts are produced by Nash, the only licensee for manufacturing this big power plant.

While some phases of this gage control system now are used in other plants, it is believed that the overall program as developed by Nash engineers is new to mass production machining operations.

The system combines the use of "picture drawings" at all machines, boxes for holding gages used on each machining or inspection operation,





Mounted on plywood boards are gages required for checking operations at each machine. Inspectors check instruments regularly and make adjustments.

boards on which gages are mounted for fitting parts to them, and a simplified method of segregating rejects.

Picture drawings, hung at each machine, show in light outline the part being produced. Position of the part in the finished product is not indicated. Heavier lines indicate the surfaces to be machined, and all necessary dimensions are shown. These 8½" x 11" blueprints specify the tools and gages to be used by the operator. No limits are indicated except those to be maintained at the station.

Use of this type of drawing has been found especially valuable by Nash in adjusting green workers to the precision machining operations involved in aircraft engines. Though adoption of this device is spreading in the automobile industry its utilization is seldom seen elsewhere.

Secret of the success of the gage control system is "motion economy", frequently applied to machining and bench work but less frequently to straight inspection.

On production runs, a plywood gage board is set up near each machine. Arranged on these boards are all working gages required to inspect the part being machined.

Mounted on the panels are snap,

plug, plain and thread gages, as well as dial indicator gages. The gages are so positioned that parts can be easily checked, frequently without removing the gage. The picture drawing of the part, adjacent to the machine, indicates the inspections to be made and gages to use.

It is never necessary for machine operators to visit the crib or another machine to procure a needed gage. And they are relieved of all responsibility for the tolerance of the gages they are using. Instruments on boards at the machines are inspected, adjusted, or replaced regularly by roving inspectors who use portable gage checking carts fully equipped with "Jo-blocks", checking instruments, tools and tolerance records for every gage in the shop.

On the boards, plug gage nibs are removed from their handles and mounted for use, with "go" and "no go" gages side by side. Because the operator makes his first inspection on an instrument fixed at one end of the board and moves successively across the board, there is little possibility that a necessary inspection will be missed.

Motion economy is achieved here by eliminating tedious picking up and laying down of gages. Because gages

are never scattered about the machine, reduction of gage maintenance work is really substantial.

Inasmuch as every gage used on production runs carries a serial number, roving inspectors can check their record books to determine the working limits on any gage before it must be sent to gage repair in the Inspection Department.

For use on short runs of machined parts, when inspection is made either at the machine or at inspection tables at the end of the machining department, small wood boxes containing all the gages needed for inspection of each part are stored in nearby cribs.

The end of each gage box is marked with the engine part number and picture drawing to accompany it, making it possible for the crib attendant to pull the box rapidly from the shelf and deliver in one operation all the gages necessary for any one job.

The soft wood boxes, purchased in three sizes to accommodate all the gages used on any engine part, are partitioned with wood sections and suitable recesses to hold all types of gages in place and prevent them from sliding about.

Design of the box interior permits fast and convenient removal and replacement of gages. Where required, masters for setting indicator gages are built into the boxes, and dials are marked in red to indicate limits.

More than 2,600 boxes are in use in the Nash-Kenosha plant alone, and each contains from one to 25 gages. Despite the large number of gages on this aircraft engine job, tremendous overall savings are effected by speed-up of inspection operations.

#### BOXES ARE SPECIALY DESIGNED

Pre-positioning of gages in a box completely eliminates search for and selection of the proper gage, and idle time due to single-handed work is eliminated by simultaneous part and gage handling.

When this gaging system was installed in Nash, care was exercised in grouping checking operations so that each inspector in a series of inspections had approximately the same amount of work to perform. Consequently, work does not pile up between inspectors, nor must any inspector wait for work to come from the preceding station.

Motion economy also has been applied to the handling of rejects from inspection benches. Previous prac-

tice was to tie a colored tag on rejects and send them to the salvage department where it was necessary to reinspect the part before determining what disposition to make of it.

The new system at Nash calls for the use of boxes into which rejected parts are placed for removal from inspection benches to the salvage department. Tacked on the front of each box is a card on which appears an outline drawing of the part being inspected. Thus the inspector may note on the card all incorrect dimensions on the rejected part. Spaces on the card are provided for the date, shift, part number and name, and number of pieces with the same defect placed in the reject box. Error from required tolerance is indicated in spaces provided in the drawing.

#### NEW DEPARTMENT ESTABLISHED

Possible reworking of a reject part is determined right at the inspection bench at the end of each machining department. The line supervisor, by looking at the tags on the reject boxes, can go back along the machines finishing the part in question and correct the cause of error.

Under this new system, paper work involved in inspection and salvage is reduced to a minimum because the system functions automatically.

In order to maintain the extreme tolerances demanded on the 50,000 separate gages used on the aircraft engine job at Kenosha, a special department was established by Nash.

The master gage department checks every new gage brought into the plant. All close-limit gages are checked in a constant temperature room, maintained at 70° F. There, gages are set for 24 hours before they are checked.

Gages are delivered to tool cribs and gage boards at machines on the order of the roving inspectors who continually check the tolerance and condition of working gages in the shop. Bicycle delivery trucks are used between the gage department and the machine shop for this pickup and delivery service.

Whether gages are used constantly, as are those on the gage boards at the machines, or intermittently as are those in boxes stored in tool cribs, they are inspected at precise intervals by roving inspectors. Plug, thread and snap gages within .0005" are checked every 24 hours, usually in

### Motion economy applied to handling of gages, salvaging of rejects, and maintenance of inspection tools saves thousands of manhours

the morning. Gages in the .003" range are checked every two weeks.

Nash engineers take justifiable pride in the low rejection rate on Pratt & Whitney finished parts, crediting this inspection system.

Parts are checked at each machine, with complete inspection being made by the operator on all surfaces he has machined. Then, at final inspection performed at the end of each machining department for major engine parts, a complete set including every gage required on individual machine inspections is used to make a final inspection. Through this system, parts that might be rejected in final inspection for lack of tolerance are generally caught before a complete machining job has been performed.

To eliminate numerous hand gaging operations on all large milled or turned jobs on the aircraft engine, the Nash inspection department has designed and built special checking

fixtures that eliminate six to as many as two dozen individual gages.

A flush pin checking fixture, used on the magnesium auxiliary blower section, determines tolerance simultaneously on 20 different surfaces. In this fixture every surface is checked in relation to the main bore of the engine, and the angle of each surface is checked in relation to all other surfaces. Consequently, each individual surface on the work piece is checked simultaneously in more than one spot for flatness and angle.

Indicative of results obtainable with such fixtures is one which eliminates more than two dozen gages and has reduced the length of the panel for holding hand gages from 24' long to less than 5' long. Manpower savings through use of these fixtures also is substantial, for the last fixture mentioned has alone eliminated the need for three regular inspectors.

THE END

Gages for short runs are stored in wooden boxes, held at the tool crib.

Nash-Kelvinator photos

Regular pick-up and delivery service is maintained between crib and shop. Gage replacement is made at order of the roving inspector.



W. J. Savage  
photos



Milling machine with cutter produced from scrap ends of nibbler cutters, has speeded production and relieved planer and shaper for other work. Job consists of machining top and bottom surfaces of legs for machine fixture.

## Are Your Machines OVERLOADED?

**Knoxville machinery manufacturer designs jigs to put shaper jobs on milling machine or boring mill. Other setups increase production from 50 to 400 per cent on shapers, planers and radial drills**

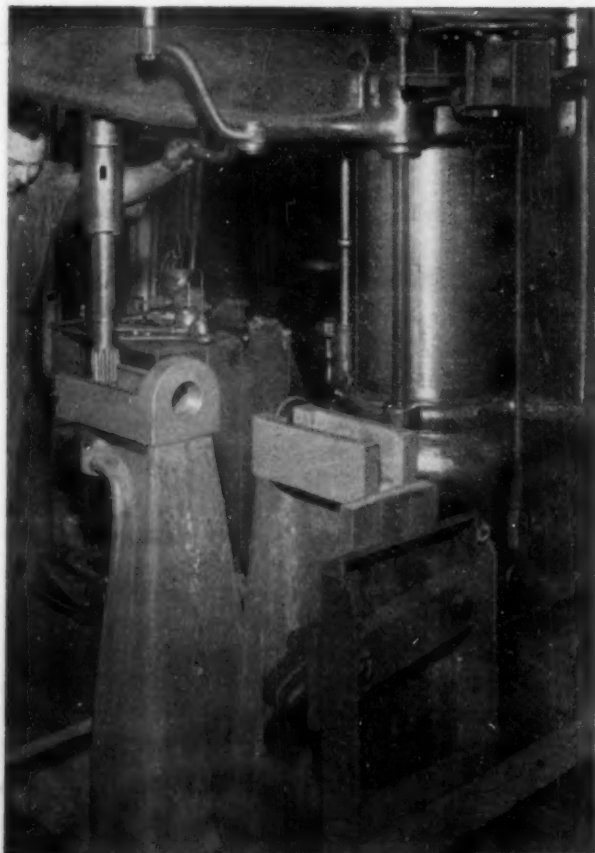
**GERALD ELDRIDGE STEDMAN**

BY RE-ARRANGING shop layout, and improving tooling and jiggling, the W. J. Savage Company of Knoxville, Tennessee, has increased production of machine and structural parts 50 per cent, while decreasing employment 1.5 per cent. The company maintains its own foundry, which designs patterns and works 30 days ahead on castings. Brass, aluminum, and gray iron are cast up to limits of 10,000 pounds.

In addition to a regular production setup for machining cast and welded parts, a jobbing business is maintained which entails overhauling anything from a watch to a locomotive. A typical job is that of machining a flour mill drive shaft, where a 9-1/2" diameter shaft is set up on an American Pacemaker lathe. Held in a 4-jaw 18" chuck, the shaft is turned at about 21 rpm. With a .0025" feed, a 3/4" cut may be taken.

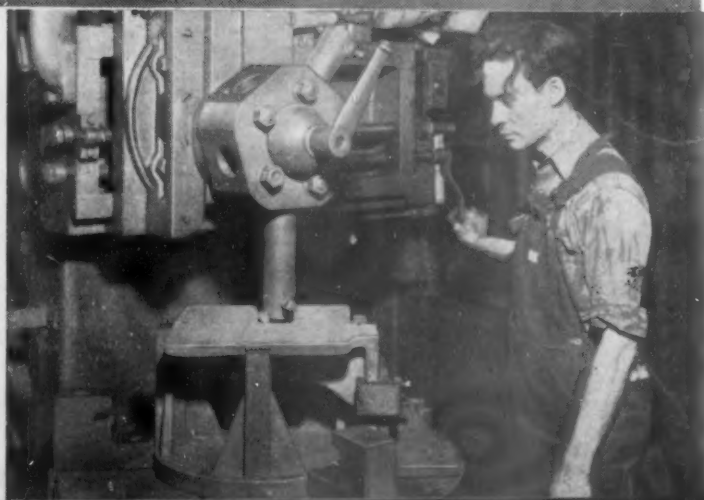
According to W. A. Stern, the company's master mechanic, handling such a wide range of work sharpens mechanical senses. Feeling that they are learning something every day, the plant engineers are making their education pay its own way.

On production runs, where savings are shown most easily, special tools and fixtures are finishing cast machine parts precisely. For example,



Leveling and holding jig permits line reaming of main bearing of a machine frame on a radial drill. Part is fabricated from scrap steel plate, welded.

**Below: Clamping fixture adaptable to three types of motor bases permits placing typical shaper job on boring mill. Production is increased 50 per cent.**





a collet nut held to plus or minus .001" is produced in two operations to a thread and taper fit.

A special jig has been designed for shaping the corner radius of a 4- $\frac{5}{8}$ " diameter part, reducing production time 65 per cent. Used on a 20" Cincinnati shaper, the jig swings over center. An extension plate is clamped on the shaper table, and a dividing head and tail stock are bolted onto the extension plate. Automatic centering of the part is provided, with the index head being used to swing the part through the correct radius. Location, indexing, setup, and clamping are speeded by use of this jig, and accuracy is assured.

#### SAVES SETUP TIME

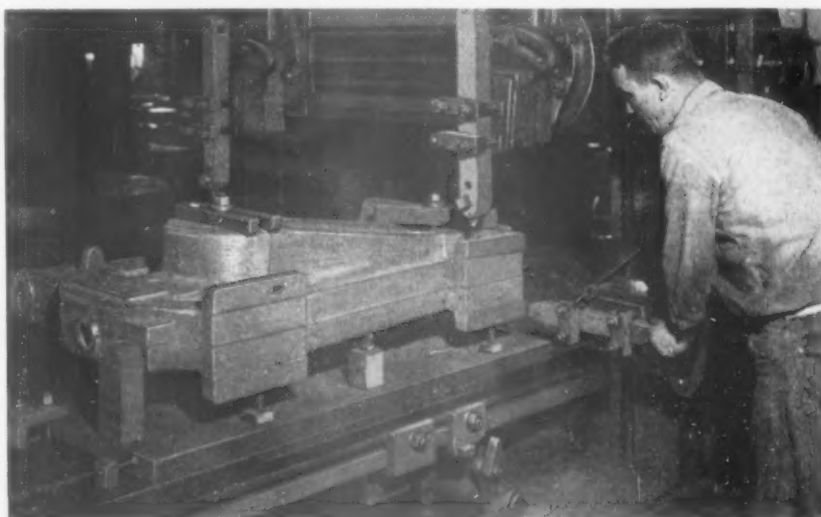
Three hours per operation were saved on another job through the use of a special jig for planing surfaces of a machine foundation on a Grey 60" x 12' adjustable planer. Formerly, foundation pieces were set up once for each surface to be machined, which meant locating center, blocking, and shimming each time. The new jig has a series of set screws which automatically center the part. The second set-up is eliminated because the jig simply swings the already-located part to the second position.

Another jig and a series of drills have been designed to increase production on an American radial drill. Where eight hours were formerly required to finish a boring operation on one machine frame, five frames are now bored in ten hours. A series of reamers is used with a die jig to rough bore and ream with one bar, and



Leveling and centering swing jig for planing two surfaces of machine frame saves one locating operation. Total setup saving is 75 per cent, because remaining location job is facilitated.

Below: Leveling and centering jig for planing machine frame is shown swung to second position.



#### SOUTHERN INDUSTRIAL CENTER

Largest of the nation's soft coal producing regions, heart of TVA's hydro-electric development, rich in 40 important minerals, East Tennessee with its industrial advantages has attracted such manufacturers as Aluminum Company of America, United States Steel Corporation, American Zinc Company, and the Tennessee Eastman Corporation.

Knoxville is the booming industrial center of this area, possessing excellent transportation facilities, including a nine-foot channel on the Tennessee River which ties in with the waterways of the Great Lakes and Mississippi River.

Among Knoxville's 160 manufacturing plants, that of the W. J. Savage Company, described in the accompanying article, holds an import-

ant position. Its block-long plant includes such departments as engineering and tool design, machine, structural, pattern shop and foundry, and sheet metal.

Its machinery has been long known to the coal mining industry. Lately, 90 per cent of its once highly diversified business has been devoted to manufacture of machine tools, chiefly nibbling machines with a capacity for plate up to  $\frac{7}{8}$ " thickness.

Recent surveys indicate numerous production deficiencies throughout the South, compared to use requirements. For example, only 1.57 per cent of machine tool requirements are produced in this region. Such companies as W. J. Savage are developing production advantages.

finish ream with another. The bore must be perfectly located and aligned with other dimensions of the part.

Difficulty of obtaining equipment ties in with an established policy of using shop equipment on hand whenever possible. When planers were overloaded, methods were devised to permit use of a 30" vertical boring mill, with special jigs, to produce motor bases. Production on this item was increased 50 per cent.

Two legs for a fixture must be machined on top and bottom surfaces. Formerly, this was done on a planer,

requiring the highest-rated operator. An inserted-tooth milling cutter was designed, using the scrap ends of high speed tool steel cropped from nibbler cutters. The cutter was first designed with 22 teeth, but insufficient room was left to clear chips. The best operation was performed with 11 teeth. Production was increased 60 per cent.

•  
In keeping with the tendency being exhibited in a number of busy shops, Savage production engineers are favoring the development of design ideas in material. Detailed drawings

for the record are produced only after production models have been made. Obviously, this policy is an outgrowth of adapting and utilizing fully the equipment already in the shop.

In assembling a semi-heavy machine, with a total of 270 parts, efficiency was increased 75 per cent by installing a traffic line of subassemblies, flowing to final assembly in batches of 24 units. This required change in floor layout, installation of overhead cranes, and movement of men to the work, rather than work to the men.  
THE END

## Short Cut to Accuracy in Line Reaming Shaft Flanges

● A LENGTHY JOB, difficult to do accurately, is the line reaming of tapered holes through line shaft flanges under ordinary conditions, and with standard tools and methods. A short cut to this job, which offers greater accuracy, has been developed and a patent applied for by Joshua Hendy.

This division put into successful operation a portable machine tool which line reams the tapered holes to tolerances of .001" or less for fitted bolts. The operation was formerly done with a portable pneumatic drill, or by hand. Perfect alignment was never assured with the old method, and considerable time was consumed

in obtaining maximum results. The new portable line reamer assures alignment and shortens time required for the job. Its portability permits line reaming to be done in a shipyard, or in the shaft alley of a vessel.

The assembly has three basic parts: (1) four cast iron cradles or pedestals to line up separate shafts, if required; (2) reaming unit, a frame holding reamer and standing shaft; and (3) a set of reaming bits.

The machine is mounted on the flange of the line shaft coupling and is aligned with the hole that has been rough drilled to predetermined size by inserting a plug in the hole next to

the one to be reamed.

Excess stock is removed from rough drilled holes by means of a "porcupine" tool, consisting of a solid body with a series of 17 cutters spaced spirally around it. This roughs out stock to within about 1/16" nominal size. The roughing reamer is then inserted and removes stock to within .010" or .012". After this, the sizing reamer completes the hole. The shaft is then rotated and the machine indexed to position for the next hole.

The cradles or pedestals are designed with leveling screws for elevating, and adjusting screws for lining up the separate shafts. Each cradle is equipped with cast rollers for revolving the shafts. The reaming unit is handled by a crane or chain hoist and is lowered onto the joined flanges of the shafts and rigidly fastened in place. The gear reducer drive and feed are mounted on the cast iron frame of the reaming unit.

Reamers are quickly installed and removed. Holes for the locating pin are in the cast iron frame. After reaming each hole, the unit is loosened and hoisted above the shaft and the shaft rotated. The unit then is lowered, located in the proper position, and fastened in place for the next reaming operations.

The reamer is driven by a 1-1/2 hp motor with a reduction unit.

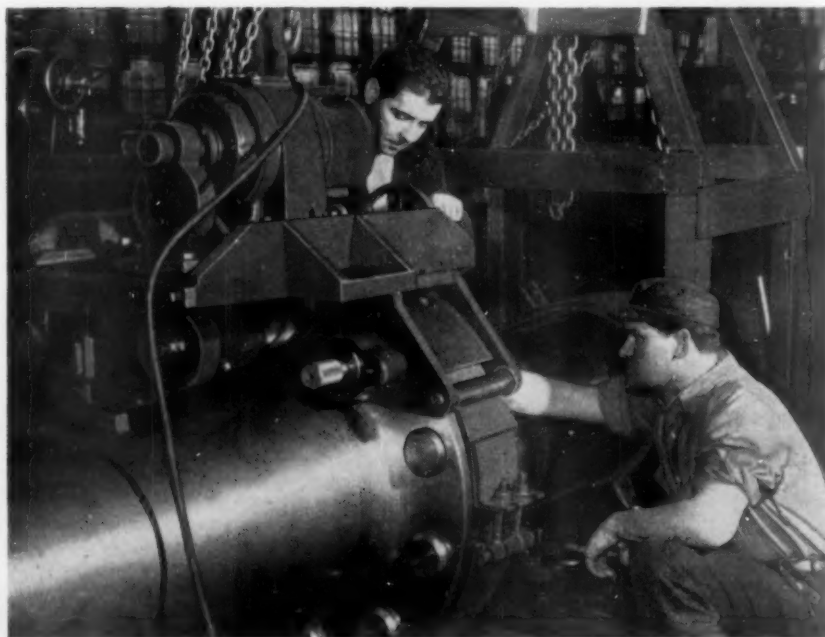
The semi-finish reamer is designed with seven flutes. The finish reamer has eleven flutes, designed so that each flute has an advance of one or two degrees. This unequal spacing avoids the chatter which exists in reamers with evenly spaced flutes.

THE END

THE TOOL ENGINEER

Placing line reamer on drive shaft to taper ream connecting bolt holes in flanges. Note locating method.

Joshua Hendy photo



# PRODUCTION

ACHINE & TOOL ENGINEERING



Several designs of low-cost fly-cutters permit rapid machining to form, or combine roughing and finishing operations.

## TOOLING TO INCREASE PRODUCTION EFFICIENCY

Improved manufacturing methods employed by Douglas Aircraft Company, Inc., range from use of simple, but broadly applicable, fly-cutters to ingenious development of "sample" dies. For information on small-scale die experiments, see page 78

THE TOOL ENGINEER



# Streamlined Production

## TOOLING TO INCREASE PRODUCTION EFFICIENCY

**Douglas-designed tools, dies, jigs and fixtures  
—plus streamlined assembly methods—permitted  
250 per cent production increase on light bombers**

**S**MART TOOLING must be judged in relation to the limitations imposed by equipment, plant space, the material being fabricated, and the design of the product. One plant may turn out more parts or assemblies to a certain specification than another. This does not necessarily mean, however, that smarter tooling was employed as compared to a plant producing less. In fact, the plant with higher output may not offer as much "know-how" for careful study, simply because its limitations are so much less than those normally met.

In the case of the Douglas Aircraft plant at Santa Monica, California, production development has been in the face of limitations of space and, as with most aircraft builders, of equipment suited to specialized jobs. But, despite these handicaps, Douglas is turning in one of the best production records in United States plane building.

Douglas production history shows no record of production holdups of major consequence to permit re-tooling for added output. There is no record of sufficient advance information to permit increasing production of

the A-20 bomber in sufficient plant space. There has been only the need to keep planes coming, to take production increases without faltering.

Aircraft parts fabrication at Douglas is divided into two major classifications—machining and forming. Machining includes broad use of conventional equipment. The Santa Monica plant offers limited opportunity to study the types of fixtures and accessories which have proved advantageous for mass-machining of aluminum and stainless steel to the precision required in aircraft assembly components. But it does furnish examples of ingenious tooling for the type of small runs which are not sub-contracted.

Forming includes a broad range of press work, with emphasis on the increased application of stretch presses and decreased use of the drop hammer. The use of various die materials, regard for the physical properties of aluminum and stainless steel, the trend toward forming of larger sections, and a method of sample die construction are particularly worth noting.

### Improved Machining Setups

**T**HE DOUGLAS MACHINE SHOP is one of the largest west of the Mississippi River. With few exceptions, its main output is of a jobbing nature, with some of the orders consisting of "piloting" jobs which will later be sub-contracted for mass manufacture. Certain high production jobs are handled, however, as equipment is available for the work.

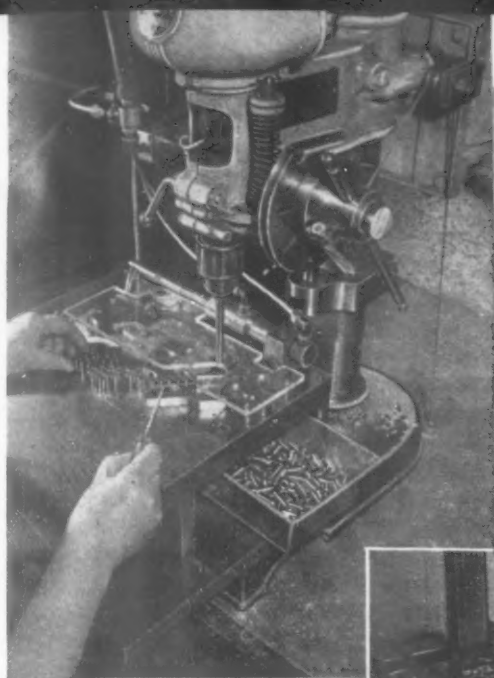
Such high production work as is handled in the shop furnishes examples of how improvements in tooling have been made to supply more parts to meet increased assembly schedules without a proportionate increase in the input of manhours and machine time.

A large share of this improvement has been accom-

plished by applying pre-loading and indexing fixtures, automatic feed and ejection equipment, and quick acting air clamps. Such developments are based on the premise that important savings can be effected by reducing non-productive time, that is the time required for other than actual machining operations.

Certain developments, however, have been instrumental in reducing the actual machining time. Typical of these is the "fly cutter" used on milling machines. Square tool bits mounted in the body may be staggered individually or in series, and the individual cutters ground to desired forms. Thus, any shape may be obtained, and to any width within the range of the body without employ-

SPECIAL FEATURE BY THE EDITORS



**Above:**  
Pneumatic fixture feeds work to V-block, where air-actuated piston holds it for counter-sinking. With release of spindle, piston withdraws and a blast of air ejects the work.



**Below:**  
Turntable operated from longitudinal drive on milling machine table permits milling small forgings rapidly.

Quick-acting clamps permit pre-loading of 24 pieces.



**Above:**  
Air-actuated toggle clamp builds up powerful leverage required to hold certain fittings. Actuation is reverse of that provided by conventional tongs for lifting ice.

ing expensive special form cutters. These tools are efficient.

Work indexing fixtures have been applied to the turret lathe with success. The only limitation is that point where more tool changes are required than can be justified by the saving in chucking the work for a second operation on another machine. Certainly, however, when the required number of tools can be held in the turret for operations on two or more positions of the work, there is production economy in the application.

Such is the case where Douglas machines angle fittings. One precaution which must be observed is that operators must take care to follow the proper sequence of operations for each positioning of the part. One position of the work may appear much the same as another, though different tools are probably required in machining to specifications.

Increased use of two and three jawed chucks has cut the time required to load and unload work for turning operations. Boring soft chuck jaws on the job has been an aid to maintaining concentricity, particularly where any amount of spindle bearing wear has set in. Two-jawed chucks have proved useful in speeding loading in that they eliminate the need for tightening set screws.

The problem of keeping up with increased assembly schedules has been met in some cases with preloading equipment. In milling surfaces on a small steel forging, heat-treated to 125,000 to 145,000 psi, a 20" diameter turntable has permitted almost continual machining by a vertical milling machine. The only non-productive time is that required to advance the fixture the fraction of an inch which lies between one piece of work and another. The table turns continuously at a rate of three to four inches per minute. It is gear driven from the longitudi-

al feed power hook-up on the milling machine.

Twenty-four parts are loaded in the fixture, and are held securely by hand-operated, cam-action clamps. Six-inch cutters produce a finished surface on the present operation. As previously performed, milling one piece at a time, a large cutter was used, and the surface was such that a finish grinding operation had to be performed to meet specifications.

A rather intricately designed fixture, based on a simple principle, permits countersinking small washers at a tremendously increased rate over previous methods. As many as 1200 washers may be machined in a single hour—the rate depending upon the speed of hand and foot action of the operator. The old method did not permit countersinking more than 800 pieces per 8-hour shift.

Following a covered channel, the work is fed by compressed air against a stop where a pneumatically actuated piston holds it firmly against a V-block for the countersinking operation. With the release of the piston, a blast of air clears chips and blows the work through a hole in the table.

Cam control of the drill press spindle stroke permits limiting travel distance to the minimum essential clearance, and is thus a factor in maintaining top speed.

Obviously, feeding small work of this type can be both slow and laborious, if hand methods are counted upon to any considerable extent. All that the improved method requires of the operator is that he maintain a flow of the small parts into the mouth of the channel. This is easily

*Streamlined Production*

done by sliding the parts across the table of the drill press. Spindle stroke is actuated by pedal. A glass lid, forming the roof over the metal channel through which the work feeds, permits constant supervision of the flow of work to the spindle.

Increased use of vise jaws for simple clamping operations has not only saved construction of holding fixtures, but in those applications where used has provided as good or better means of clamping than afforded by more complicated devices requiring set screws or lever hook-ups.

Douglas tool engineers treat each machining job as a separate problem, as far as possible. In this way they avoid the fads which are evident in many plants. Such faddishness usually follows the successful application of some appliance or new approach to a problem, and consists of using the solution to the one problem on all possibly conceivable cases which follow, without proper investigation to determine whether the application is the most economical.

One special clamping fixture which has proved effective however, is based upon an air-actuated toggle setup. Through an action which might be compared to that of ice tongs in reverse, the advance of a pneumatic piston builds up a powerful clamping pressure in two jaws. Used as a milling fixture, this device has proved applicable to a series of operations along the length of a large tubular fitting. The sequence consists of boring the I. D., turning O. D., facing the end and turning a chamfer.

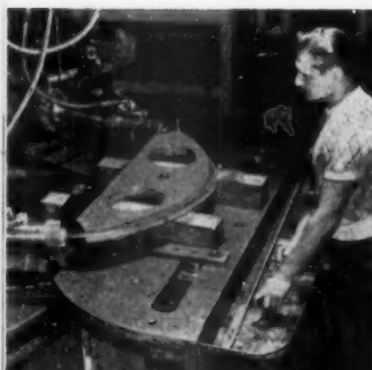
A simple type of holding fixture for drilling with multi-

## Streamlined Production

ple or single spindle presses consists of a base plate with locating stops which assist in speedy layout of the work. The lid or top of the jig, complete with bushings, is laid over the base, and work, its position aligned against stop blocks. The weight of the lid serves to hold the work securely against the downward pressure or upward pull of the tool. The lateral movement generated by the turning tool is offset or countered by the stop blocks.

An illustration of the type of rugged milling machine beds and frames which are required for machining certain aircraft parts has for its background one of the high-speed setups designed and built by Douglas, before such equipment was made available by a regular manufacturer. In this instance, however, the rapid feed, speed of cutter revolution, and high horsepower required were not factors. The work itself, a large rolled capstrip billet, proved to be the headache. The spar cap mill had worked successfully on fairly large extruded work, but the need for sizes so large that rolled stock was required, introduced a new factor. Upon taking a light cut, surface strains were relieved to the extent that the part bowed with sufficient force to lift the ends of the frame from the floor. A heavier frame and clamps have solved the problem, permitting successful machining of the part.

## Forming for High Production



**Left:**  
Hydraulic pistons swing around form block simultaneously. Valve action permits "slipping" power in either side.

**Below:**  
Bending machines incorporate stretching action for contour forming of aluminum channels. Form block is stationary.



**B**ECAUSE OF THE GREAT preponderance of forming work done in the Douglas plant to fabricate bomber and cargo ship parts, improvements in this phase of metal-working loom largely in any consideration of production streamlining.

Broadly, advances in this field consist of reducing the amount of drop hammer work on aluminum or stainless steel, and thus the amount of hand-finishing required to complete parts. They also consist of speeding the production of dies, through use of plastics, and even concrete, of working toward the forming of larger sections so as to reduce the number of components required to produce a sub-assembly, and of incorporating stiffener beads in the forming of sheets to eliminate need for welding or riveting stiffener channels to large sheet areas.

Probably the greatest single advance in forming has been in the application of stretch presses to the forming of drawn shapes, and of bending machines incorporating the stretching principle in contouring channel sections.

In bending channel sections around form blocks to specifications, a machine with hydraulic forming actuation and pneumatic chucking action is used. Similar to the forming machines described in previous issues of the Tool Engineer as being used by the E. G. Budd Manufacturing Company and the Goodyear Aircraft Corporation, this particular machine differs in that the form block is held stationary and the hydraulically powered pistons pull the work around it.

Benders, designed and built by Douglas, do make use of the rotating form block with a piston and shoe thrust



against the block under constant hydraulic pressure.

Lever control of the commercially produced machine permits co-ordinated action between the pull on the pistons and their pivoting from a common center, so as to bend the work around the form block and give it a "set" through a stretching action. Though pulling action cannot be increased in one cylinder, as against the other, the effect of increase is obtained by operating valves which cause either piston to "slip". Such a differential is required when smaller radii are to be formed close to one end of the form block and thus closer to one of the pistons. Such radii obviously create greater resistance to stretching the work around the block, and relatively greater force must be exerted to produce the required stretch.

#### CONCRETE FORMING DIES

Work is lubricated with light oil. Form blocks are produced from Kirksite, wood, and Masonite, according to requirements of the forming or contouring operation.

Large stretch presses, used in forming complex shapes from sheet, are the now conventional type, with inverted ram operating in conjunction with the pulling or stretching action of long parallel clamps which pull against or stretch in coordination with the rising action of the ram.

Such presses have been instrumental in assisting design and tool engineers in producing larger pieces of skin for the fuselage. Douglas engineers estimate that the use of stretch presses has permitted eliminating one-third the number of skin sections required to build a fuselage.

Use of concrete dies on these stretch presses has proven satisfactory and economical. Faced with body metal to provide a smooth surface, the dies are easily made by pouring to a mold.

In forming stainless steel shapes, Douglas has instituted certain innovations which have reduced tooling expense, and through the lowered cost of experimentation, has permitted successful forming of large sections which were previously produced from several parts that were assembled and riveted together.

#### DEEP DRAWING STAINLESS

The deep drawing of a box shape, approximately 14" by 6" by 6", from 3 SO material, is performed in two steps on a double action press. From a sheet 19" by 25", with corners blanked to form a 6", 45° angle, a first draw is made using a plastic punch. The resulting shape is a box approximately 2" wider than required, and about 4" deep. The second and final draw with a Kirksite punch extends the metal so as to shrink up the wider than specified shape resulting from the first draw. The sheet is .064".

As a rule, Douglas die engineers draw as much depth as possible with the first die. However, if the remaining draw, as in a two stage operation, is unreasonably small, steps are taken to maintain more equilibrium between the operations, so as to prevent undue wear on the first die.

Experimenting with a new type of magnesium sheet which can be formed cold, Douglas engineers have found that within certain limitations, parts can be drawn that do not entail the tooling expense met in construction of dies



Concrete dies have proved workable on stretch presses. As shown here, die is faced with sheet of body metal.

for hot forming. More plastic than the conventional sheet, it has the same physicals within the limitations of forming without tearing or breaking. So far, parts have been produced incorporating radii as small as 1/2" through an arc of 180°.

Probably the biggest part of the story on forming process at Douglas incorporates the type of die design which has permitted decreasing the number of components and the number of operations required to build an airplane. Almost as important to the particular applications where used, and certainly important in the light of breath of application, are the methods of building inexpensive small scale test dies for the purpose of ironing out the bugs before the big die is built.

#### SMALL SCALE DIES FOR EXPERIMENTS

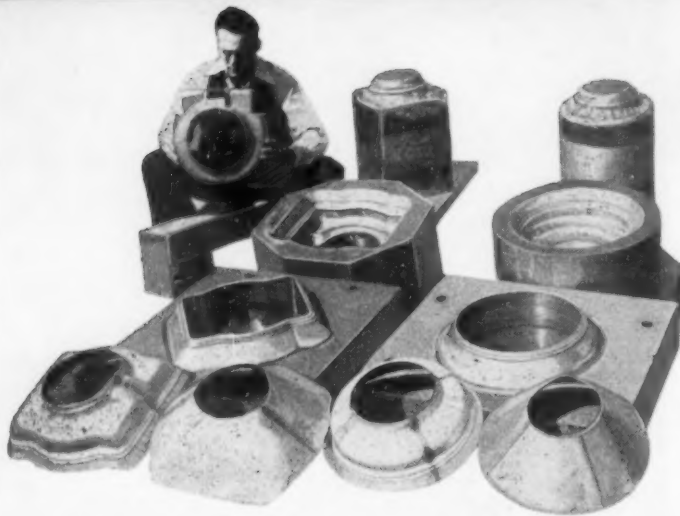
Availability of inexpensive experimentation should be an encouragement to trying improved methods which sometimes do not seem to warrant much trial and error expenditure. Dies which cost \$5000 to \$10,000 to duplicate are generally far more expensive to build originally.

In forming inner rings for both the A-20 and cargo ship engine assemblies, design of dies for use on triple action presses, incorporating stretching action entirely, has resulted in manhour savings of nearly 70 per cent. Produced from stainless steel, the original fabricating specifications called for spot welding together five segments and a box-shaped air scoop. The segments were formed in the drop hammer, requiring both hand finishing and hand fitting. The resulting assembly, after spot welding, frequently had to be further adjusted to fit into a retaining ring, and cowl flaps had to be trimmed on assembly to assure coordination.

From special rolled stock, a big sheet 56" square is blanked into a "doughnut" which can be drawn in one operation, complete with integral stiffener beads replacing channel sections which were previously welded to the assembly.

In setting up a small scale die, sheet thickness was reduced from .025" to .008". Sheet size was reduced to 10". The small scale die was turned on a lathe, with beads produced by arc welding on the die. Alterations which

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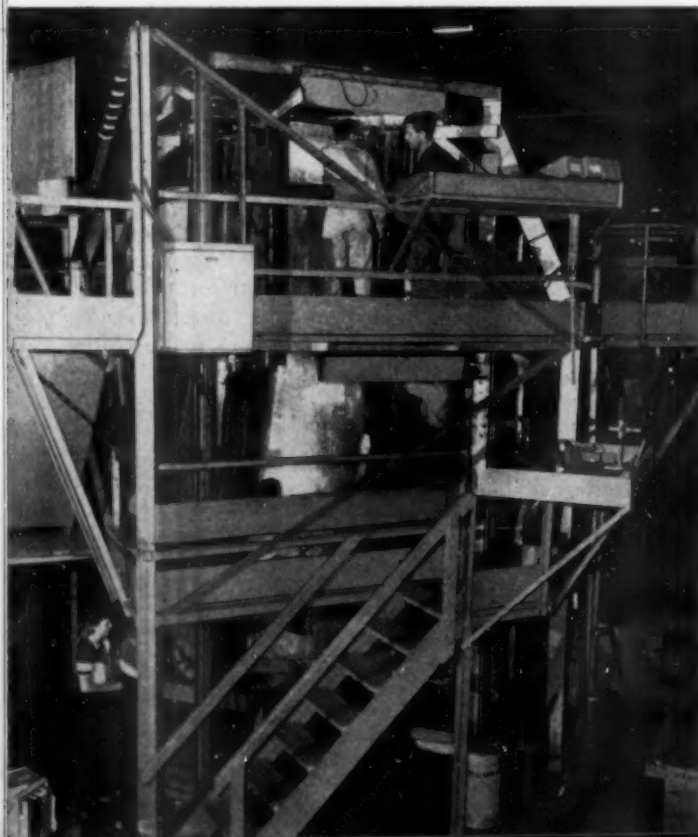


As an encouragement to die design experimentation, Douglas tool engineers instituted methods of sample die construction, permitting working out "bugs" on inexpensive small-scale dies. Shown here are quarter-scale punches and dies for forming inner ring for engine assembly. In this operation, sheets are spot-welded to form the cone shape shown at lower right. Forming from a cone reduces the stretch requirement on this stainless steel part.

were made in the small scale setup consisted of changes in the design of blank holders. As first designed, the die was made without spring blank holders. In the first alteration, or second design, a compound blank holder was tried with two different lengths of die cushion pins. In the third and final design, die cushion pins were used in conjunction with a spring loaded blank-holder. In all probability, these changes would have been required if the large die were made in the first place.

When the full scale die, costing in the neighborhood of \$7500, was built, in line with the design worked out on

**Tail cone on a C-54 cargo ship in vertical assembly jig.**



## Streamlined Production

small scale, the only alteration required was that of eliminating 25 per cent of the springs, in that loading proved a little heavy.

In some ways, a more interesting example of production economy, and certainly a less conventional forming application, is found in the forming of a smaller inner ring. Though the forming operation is performed on a larger sheet than was previously used, the sheet itself is produced from segments spot-welded together into a cone shape.

Such an assembly of segments serves the major purpose of providing a shape from which a part can be drawn without exceeding the elongation limits of 18-8 stainless steel, and at the same time permits use of standard size sheets instead of special rolled stock.

As formed, this inner ring is produced in two sections, a bottom half and an upper half, which are spot-welded together with a splice plate. Bottom halves are formed as segments of a complete circle which is cut in two on circle shears. The circle is produced from a cone of four segments. In sawing apart, two diametrically opposed seams are eliminated. The reason for forming from welded sections, rather than producing individual segments to finished shape and then welding, is that better coordination is established with relation to future assembly. Welding after forming results in distortion.

### PRECISION STAMPING

As mentioned above, forming from the cone shape, which is easily produced by welding curved flat sections together, is necessary to decrease the elongation from forming. As it is, Douglas engineers are stretching as much as 14 to 16 per cent.

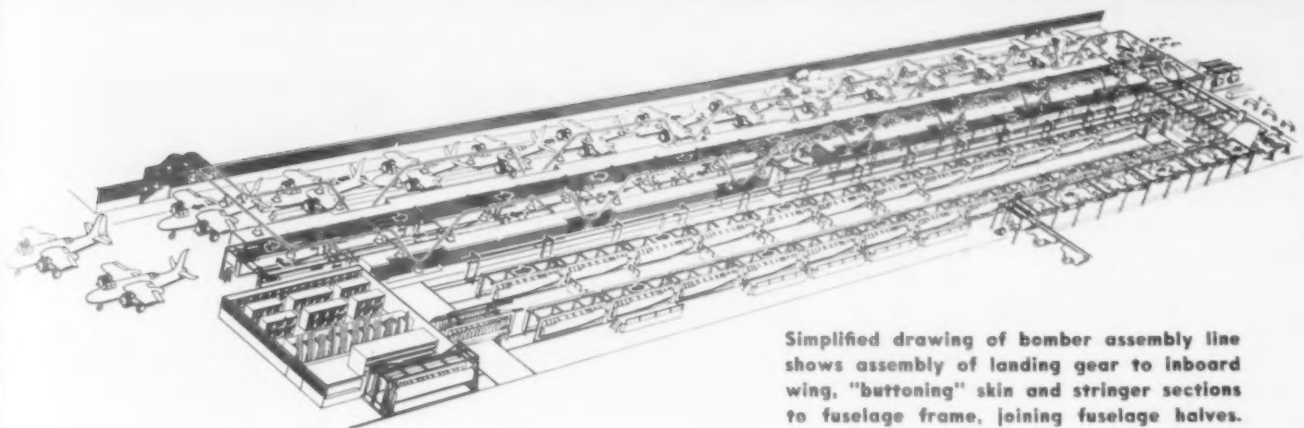
The top section of the inner ring is produced similarly to the bottom, with the only difference being that of providing for the square projection of the air scoop. In addition to cutting the halves apart with circle shears, square corners must be cut adjacent to the air scoop to provide for the wing shielding.

One valuable improvement is found in the use of the triple action press as compared with that of the drop hammer. Where the new setup is a stretching operation in every respect, the typical action of the drop hammer consists of a combined stretching and shrinking action. Stainless steel does not shrink gracefully. In building a sample die for experimentation on drawing this part,  $\frac{1}{4}$  scale was used.

One of the most dramatic savings effected by forming from larger sheets and eliminating assembly operations, is the new method of producing firewalls from corrosion resistant steel. Where 30 odd parts were fabricated and assembled before, by welding and riveting parts to a blanked and trimmed sheet, two pieces are now spot-welded to form a single sheet which is drawn, complete with stiffening beads and cups to clear certain motor attachments.

Unit production time has been reduced approximately 1000 per cent. Tooling time for a run of more than 3000 ships has been reduced by 4249 manhours. Nearly 75,000 square feet of material are conserved.

**THE TOOL ENGINEER**



Simplified drawing of bomber assembly line shows assembly of landing gear to inboard wing, "buttoning" skin and stringer sections to fuselage frame, joining fuselage halves.

## Two Classes of Assembly Tooling

**I**N MOST AIRCRAFT PLANTS, the ratio of manhours input on assembly to parts fabrication is approximately two to one. When the problem is one of cutting manhours, this phase of operations is obviously in for a lot of attention. When production schedules must be raised, it is the bugbear of the production engineer's days and nights until the sequence of operation is adjusted to meet the requested output.

The appearance of skill requirement is usually lacking in any picture of an aircraft assembly operation. Seemingly, for every five minutes of ingenious tooling application, several manhours must be devoted to the prosaic job of "buttoning up" the skin and frame assemblies.

Behind this picture, however, is the application of high tooling skill, a continual struggle to keep up with changes in plane design or production schedule.

The Douglas Santa Monica plant offers an opportunity to study two classes of tooling for assembly. In the construction of cargo ships, production is obtained with stationary jigs, with the sub-assemblies moving from one jig to another. The mechanized line, developed for assembly of the A-20 bomber is an excellent example of Class-A tooling, and of tooling ingenuity, in that an assembly line which would require several thousand feet of straightaway, is closely coiled within a building that is only 700 feet long.

In building the big C-54 cargo ship, with its 70 foot center wing, the problems of structure assembly are pretty much the same as those met in building wing and fuselage sections for a four-engine bomber. However, because the cargo ship does not carry the extensive armament and bomber controls, assembly is simplified.

Fuselage and wing structure consist of skin and stringers, panels, spars, bulkheads and floor sections. Mating these sections is comparatively easy. Actual assembly of the components is more difficult, though this is continually simplified, either by increasing the number of sub-assemblies, or by the development of larger integral units. Both types of improvement have the common result of eliminating application of manhours within a confined area.

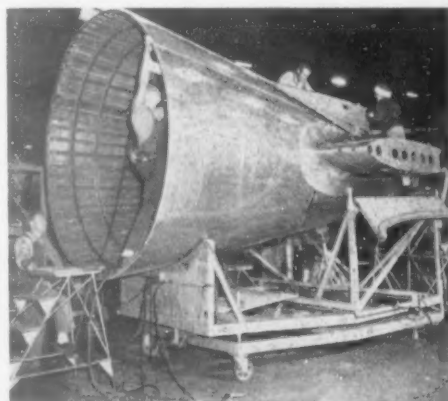
Sub-assembly away from mating jigs leaves only the "buttoning up" process for final and pre-final lines.

Two major improvements have been largely responsible for speeding this class of production, as well as for increasing the rate of output from the mechanized line. One of these is the engineering change which permitted use of butt joints in preference to lap joints. The other is the panel idea of sub-assembly, in which small sections are produced as nearly complete, with relation to a ship ready to fly, as possible.

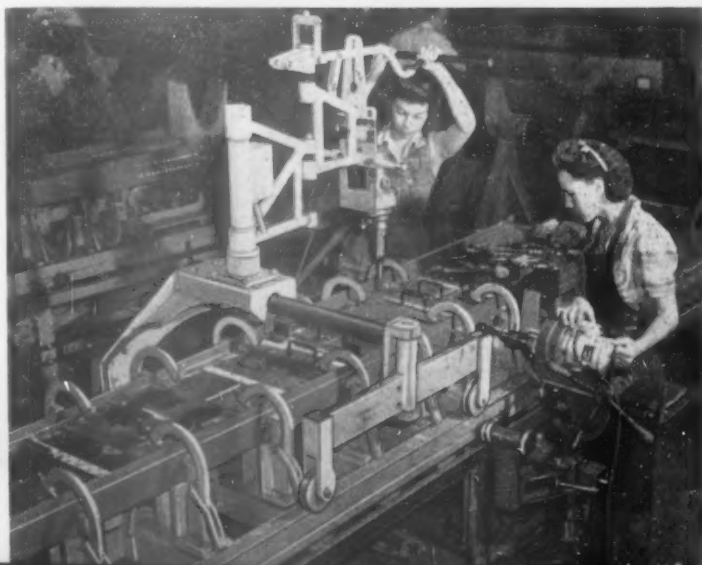
The panel idea has permitted application of automatic riveting equipment which is considerably faster than the portable units which must be used in conjunction with the large stationary jigs. Such automatic equipment, now conventionally used in most major aircraft plants, punches, sinks and bucks rivets from a single indexing head.

Usual procedure is to tack-rivet a panel on a stationary

Tail of C-54 after removal from assembly jig. Complete panel assemblies are quickly "buttoned up" in rigid jigs.



Below:  
Variety of panel assemblies may be held in trunnion jigs for drilling. The radial drills travel along monorails, work to jig requirements.



*Streamlined Production*



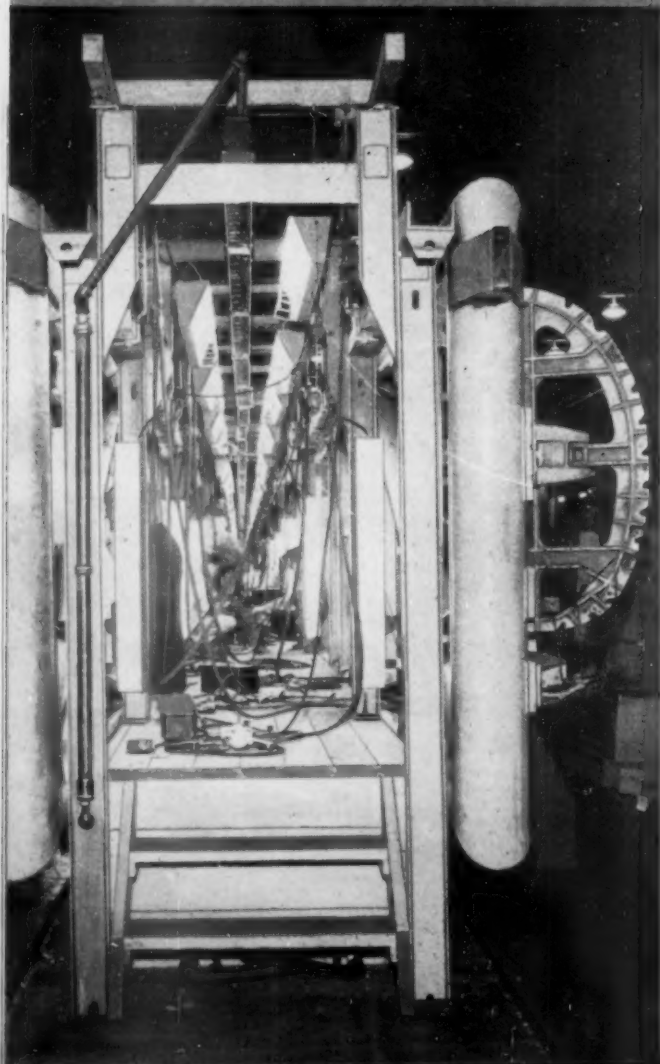
jig, and then run the panel through the automatic machine. With the first rivet driven in relation to a punched hole, the second rivet is punched in accord with a preset spacing, the head indexing from the punched hole. The rivet is driven and bucked without pre-dimpling.

A further advantage of the panel idea is that it permits careful control of parts flow to any particular assembly job, frequently permitting conveyerized parts handling. Use of mechanical handling equipment at Douglas has speeded assembly of certain small panels.

One of the biggest sub-assembly jobs is that of coordinating three large fuselage sections. These are the frame structure, the floor, and the skin surface. The fuselage is built in top and bottom sections, the bottom including the floor. Sections are constructed on each side of a complete fuselage mating jig. With the bottom section set in the jig, and the top lowered on to it, the mating operation is fairly simple. All that remains to be added are window panels which are brought to the jig in the form of completed sub-assemblies.

A master plate in the end of this jig maintains proper alignment of the fuselage in that it aligns holes which will be used for attaching the nose and tail assembly.

Rigid tubular jigs travel along monorail on Douglas "flow-line," with no support in floor. Jigs can be checked in masters, and can be altered to overcome slight inaccuracies. Spare jigs are switched into line when regulars are pulled out for checking.



## Streamlined Production

Following construction of 70 foot spars for the center wing in jigs, front and center spars are mated to make up the tank section of the wing. This includes landing gear hinges which serve as locating points. Jig sides carry quickly mounted uprights to maintain proper position between spars until bulkheads, skin and tank are secured. End locating points are relied upon to coordinate later assembly of the rear spar.

Complete center wing assembly is accomplished by lowering the rigid tank section in to mating jig. Nacelles are slid under and up into place. The tail section of the wing is lowered onto the tank section, and finally the nose sections of the center wing are raised into position.

Nose and tail sections of the fuselage are built in vertical fixtures to allow the operators to work in the most efficient position. This means that with but few exceptions, rivets are driven horizontally, skin sections and stringers are hung vertically.

Such sub-assemblies as the nose and tail are themselves composed of sub-sub-assemblies, all based on the principle of speeding the operation by spreading the work out, either to permit application of more manhours, or to relieve concentrations of manhours and congestion. Several operations are thus performed simultaneously on assemblies which were once adjacent sections on a single assembly—too adjacent to permit adding men to the job. Obviously, though more manhours may be devoted to assembly of a ship at one time, far less overall time is required to do the complete job.

### CARGO SHIP FINAL ASSEMBLY

In final assembly, center wings are moved up one side of the final assembly bays, fuselage sections up the other. Nose and tail are joined to the fuselage, clusters of wiring and cable are secured to the center wing. Approximately half-way up the final line, the center wing is moved in front of the fuselage line and laid in a cradle. The center wing is located by end plates which are attached on the center wing line. These plates are cradled in locating blocks by a single point.

Fore and aft movement of the center wings is controlled by location of bosses in slotted wooden blocks, one at each side of the fuselage position. Wooden blocks on jacks assist in supporting the wing to the location.

The fuselage is lowered onto the center wing, so as to rest on three spar pads. Location of the fuselage is maintained by a single point on the nose which controls center line and station, and by two points on the tail which control center line and height.

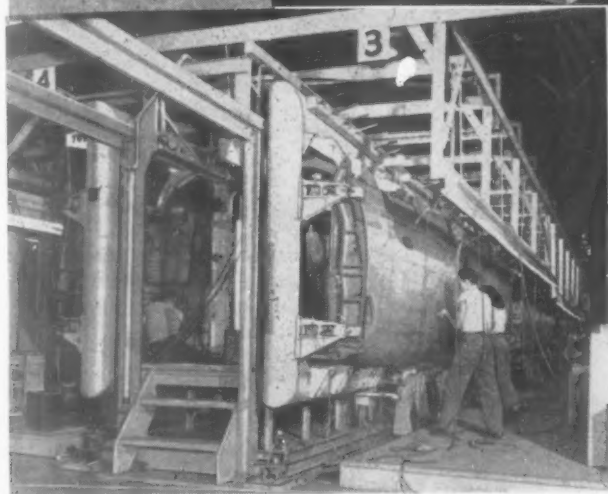
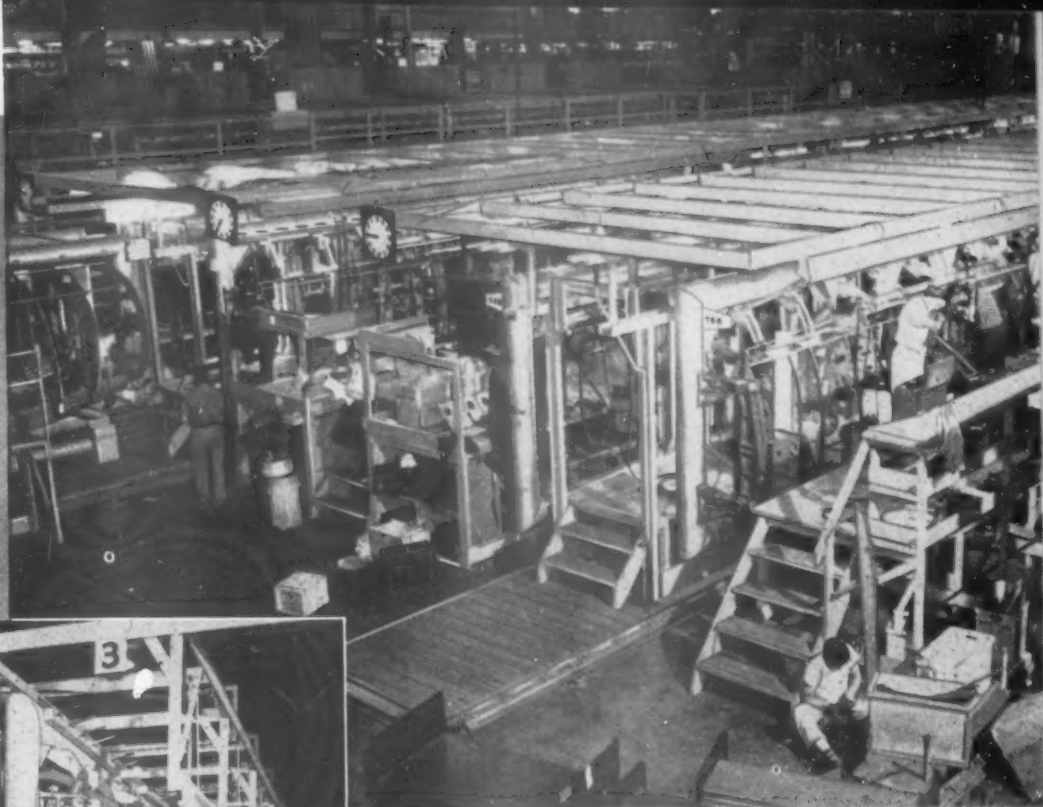
Two pre-loading jigs have been developed to speed drilling of small assemblies or skin sections. One of these consists of drill jigs mounted in trunnion fixtures, with the bushings facing downward in loading position. Flat parts are laid on top of the jig and clamped, the jig is turned over exposing the bushings for drilling. Several of these jigs are mounted in a long frame, between parallel rails, on which a radial drill travels. Pre-loading permits constant application of the drilling equipment. On still smaller work, light portable jigs are pre-loaded around a table and fed to a single radial drill press operator.

Right:

Crowding 6100 feet of assembly line into a 700-foot building demanded compact "flow-line" design.

Below:

Right and left halves of light bomber fuselage are constructed from skin and stringer panels riveted to frame held in moving jig.



Assembly of the A-20 bomber is performed on a mechanized line which requires more than a mile of moving jigs for the construction of sub-assemblies and completed ships. Biggest production problems in the achievement of this Class-A tooling job were the installation of five major lines within a 700-foot building, and of synchronizing movement of sub-assemblies and final assembly.

The job was first introduced as a problem of increasing production on the bomber 2-1/2 times. As worked out, it employs traveling tubular jigs for the construction of right and left fuselage half-shells, center wings (also right and left), landing gear, and outer wings. Every conventional type of conveyor is employed, and in the final 700 feet of line, gravity is used when the nearly finished plane travels on its own landing gear.

Certain lines pass within 10 feet of each other, preventing the use of in-plant trucking. Overhead conveyors move stock into cribs at each station, carrying the parts from balconies at one side of the building.

Stock-racks, fed from cribs, are located at the point and height of installation.

In developing a mechanized line, operations must be balanced in terms of time consumption to permit syn-

chronized flow. In most increasing of aircraft production schedules, this has meant "backing up" jobs, creating more sub-assemblies. Typical of this development was that of moving the nacelle installation on the center wing sections far back from the final assembly. This installation, requiring some hand fitting, was a bottle-neck on the final line. To do this, necessitated backing up the landing gear installation, which proved to be difficult.

The A-20 center wing is built in right and left hand sections. Installing the complete landing gear in each section meant testing each side individually instead of simultaneously. With a complete hydraulic testing unit, which fills the gear actuating cylinders with oil, the test is made to close limits. Being identical for every wing section, the movement of finished plane landing gears is assured of coordination.

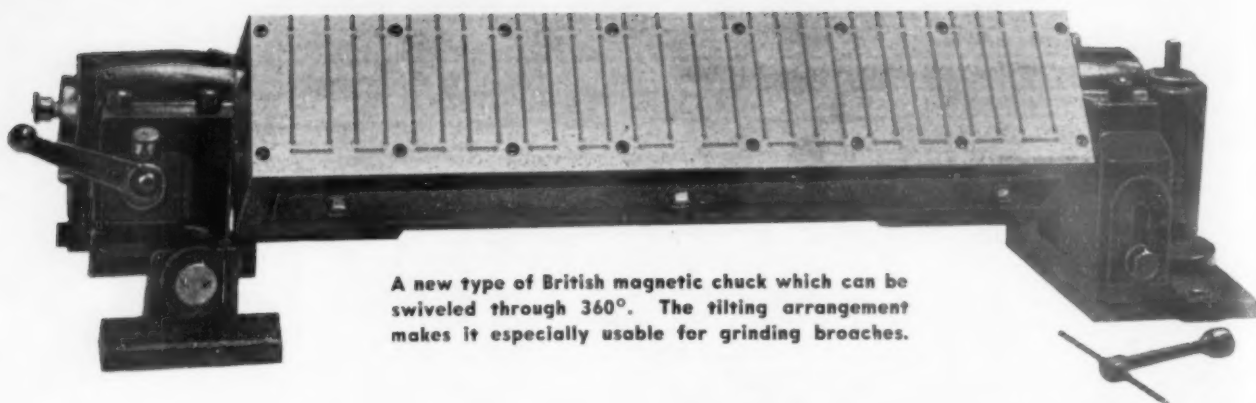
Similarly, about half-way through the assembly of the center wings, all wiring is tested with portable units. Thirty-six units are tested at this station.

The importance of installation, as compared to structure, cannot be overlooked, in that it is much the harder to provide for. Where space or manhours can solve the problems of structure, installation is limited to the floor area of the particular assembly involved. In assembling wiring, cables and tubing in the A-20 bomber, Douglas tool engineers have made use of the cluster idea, assembling these installations in sections which can be secured to panels, and then mated to clusters in adjacent panels, concurrent with fuselage or wing assembly.

In construction of a precision instrument, such as a bomber or fighter plane, it is of course necessary to maintain alignment of jigs and fixtures. Fuselage jigs, the largest of the tubular and beam-braced jigs, are checked in masters located at the end of one of the lines. Spare jigs permit pulling a jig from the line and replacing it within a few minutes. Slight twists are generally corrected in the master by bracing the jig and re-setting locating points.

THE END

*Streamlined Production*



A new type of British magnetic chuck which can be swiveled through 360°. The tilting arrangement makes it especially usable for grinding broaches.

## Design and Use of British Magnetic Chucks

ERIC N. SIMONS



For holding small pieces in large numbers, this British circular chuck of dynamo magnet steel has been developed.

**T**HE MODERN magnetic chuck must maintain work firmly in place on machines weighing more than 50 tons, and having wheel drives up to 60 horsepower. The use of 40 to 50 gallons of water a minute, or the same quantity of cutting compounds are quite common on these machines. The chuck must not only withstand this liquid, but also resist effectively the power that machines of this type can exert. British manufacturers, therefore, have devoted much attention to design.

Another difficulty encountered is the segmental wheel. While the discontinuous ring has made wider cutting surfaces and heavier cuts possible, it has introduced, through its intermittent cutting action great vibratory stresses on the chuck face, tending to cause its disintegration. The common method of keeping the poles of a magnetic chuck in place is to fill in with white metal or other non-magnetic materials to prevent leakages of magnetism. This practice suffers from the great disadvantage that continual vibration, if it does not actually loosen the metal inlay, will weaken the union between the metal and the magnetic steel. This allows infiltration of moisture to the interior at these weak places, and infiltration will destroy windings.

For this reason the British manu-

facturers introduced the one-piece method of constructing the working face, which enables a very high magnetic capacity to be combined on the pole face with positive security. The essence of this one-piece construction is that the chuck face plate is in one piece, slotted to form the poles.

The pole faces are not separated, and are not held together by non-magnetic metal. The method of construction employed makes it impossible for any pole to work loose or for any strains to be taken up by the non-magnetic metal, any movement of which would eventually admit water into the body of the chuck.

### MAGNETISM AND GRIP

The small steel bridges connecting any individual pole with the rest of the pole face are, when the chuck is in operation, thoroughly magnetized. The steel magnets on the body of the chuck are so proportioned as to supply this magnetism and at the same time provide a grip on the chuck surface not hitherto attainable. The pole face is carefully jointed to the chuck body, and the whole is impervious to moisture. Apart from the cover and the windings, the chucks are constructed entirely in high permeability steel castings and of steel forgings.

The holding power of a magnetic chuck in pounds per square inch, or

per square centimeter, depends as much on the shape of the section of the piece to be held as on the magnetic chuck itself. The hold is entirely dependent on the number of magnetic lines that can be passed through the section of the piece, and not on the total magnetism the chuck can produce.

Some makers claim a pulling power of 100 to 150 psi. This figure is usually attained on a perfectly surfaced cube of steel placed between the pole chucks, and if the poles are very small and placed one inch pitch apart, the 100-150 pounds pull may be registered anywhere on the surface, or in several distant places at the same time. Under no circumstances would such a chuck register 100 psi over the entire surface (a chuck 30" x 8" would not hold with a pull of 30 x 8 x 100 pounds or nearly eleven tons). A test of this type reveals only the intensity of the magnetism.

Another advantage claimed for the British magnetic chuck of this type is that it not only has great intensity of magnetism across the poles, but also provides a great quantity, the design allowing a large magnet area. Windings are carefully designed with due respect to heating, in order to



press the magnetic density to the highest value.

These magnetic chucks are employed in planing and milling wherever the pieces are thick enough and of sufficient area to carry the necessary magnetism. On a mild steel bar 4" x 1 1/4" x 48", a cut 5/8" deep and 3/16" feed was taken on a planing machine. The advantage of using a magnetic chuck for this work is that setting-up time is almost entirely eliminated.

#### FEATURES OF VARIOUS CHUCKS

Chucks for the largest machines embody great holding power, perfect rigidity, absence of residual magnetism, and perfect protection for the windings. Water and cutting compounds may be employed in any quantity. For the small and medium sized machines, the chucks are lighter in construction, have less height, and are not fitted with lifting lugs. For taper work, a chuck is carried on a sub-base hinged at one end and with a knurled screw adjustment at the other.

For pieces difficult to handle in ordinary magnetic chucks, such as those requiring the vertical support of parallels, thin and narrow strips, and parts offering a small area of contact against the chuck face, another type of chuck is available. By using supporting blocks of parallel or angular section, a large variety of work may

be securely held and machined to minute accuracy.

These supporting blocks must be placed parallel to the pole slots, and must be of solid mild steel or iron. Being solid, the blocks can be made cheaply, and will remain more accurate than laminated supports required on ordinary chucks. The chucks themselves are made of magnet steel, and have the same steel face as the largest type chuck, with the exception that the poles are longitudinally arranged.

A swiveled magnetic steel chuck is used for grinding angular or taper pieces, as in flat siding, edging and bevelling, for the flat facing an angle block, grinding the vee of an angle block, taper grinding a gib head key, grinding a fulcrum, and edge-grinding using a plain disc wheel. This chuck is exceptionally strong and water-tight, and will withstand rough usage. It has trunnions at the ends fitted with substantial bearings. A graduated ring is provided at one end so that accurate angles may be obtained to 90 degrees each side of the horizontal.

A recent development is a British chuck that swivels through 360 degrees and is fitted with a tilting arrangement for the grinding of broaches.

For holding a large number of small pieces, circular magnetic chucks are made entirely—with the excep-

tion of the windings—of dynamo steel, and incorporate a one-piece steel face. The design of the pole face is adapted for holding slender rings, disks, and work usually ground concentrically. Large sizes of circular magnetic chucks also are made, some with concentric and some with tangential poles.

For small surface-grinding machines, such as universal cutter grinders, a range of chucks is made of great power for their size. These are made as low as possible, consistent with magnetic strength, so as not to jeopardize the capacity of the machine. Parts such as dies, reamer blades, templates, and any iron or steel pieces with a flat face can be held instantaneously and accurately.

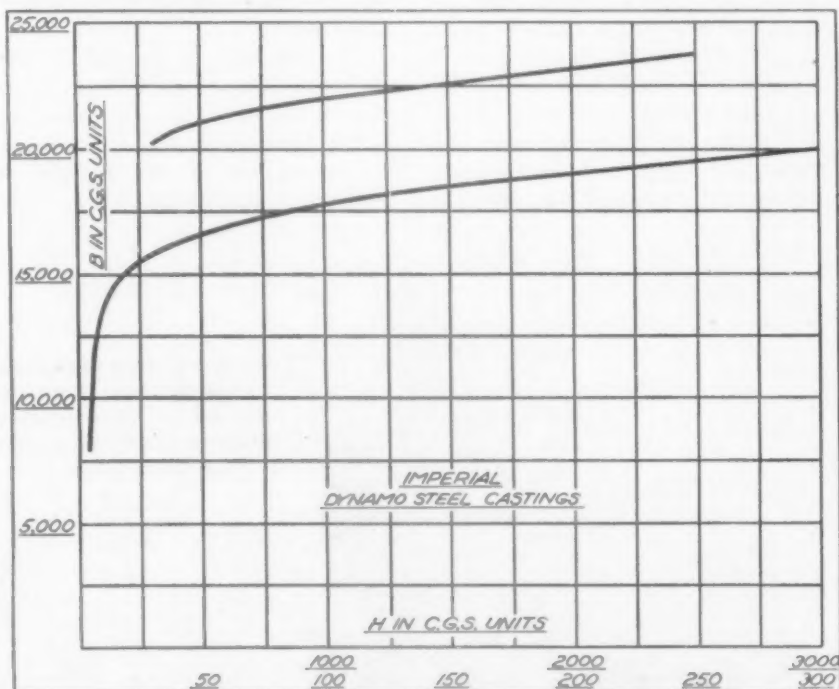
#### A SPECIAL DEVELOPMENT

Another chuck of the central pole type is specially designed for holding piston rings, and may be used advantageously where large quantities of a size are to be ground. This chuck has been developed to deal with small rings having poor magnetic qualities. The superior gripping power also enables greater production.

Working parts are all made of high permeability magnet steel, and the magnetic poles form a narrow concentric band. The narrower the band, the smaller the magnetic serrations can be made. If the band is made wider, the divisions must be

Permeability curves for magnet steel used in British chucks.

Specimen Curve: From Averaged Test Figures		
Test piece	A21/2	D85/23
H	B	B
3	8.750	7.200
5	11.900	10.300
7	—	12.020
7.5	13.450	—
10	14.230	13.450
15	15.020	14.490
20	15.520	15.050
30	16.060	15.720
50	16.750	16.490
70	—	17.010
75	17.310	—
100	17.770	17.680
150	18.550	18.470
200	19.170	19.080
300	20.100	20.020
400	—	20.730
500	21.220	21.160
700	—	21.610
750	21.770	—
1000	22.120	22.010
1500	22.740	22.630
2000	23.290	23.180
2500	23.810	23.700



less. In holding very light work, the number of magnetic edges is important. The standard faces have a working magnetic band  $\frac{3}{8}$ " wide—i. e. a diameter range of  $\frac{3}{4}$ " split rings and cast iron rings as small as  $\frac{3}{16}$ " may be held without support. Faces can be made with different pole designs for special work.

#### PERFORMANCE OF OTHER CHUCKS

Rectangular and the circular chucks have been designed for both circular and reciprocating tables. They will stand up to soda water in any quantity, will hold castings and forgings in the rough, and will hold pieces that offer, apparently, poor contact surfaces. They are strong enough mechanically to hold up against segmental wheels driven by powerful motors, without the danger of the poles being disturbed or loosened.

Other British chucks employ permanent magnets in place of electromagnets. These magnets are of nickel aluminum alloys, have no electrical connections, and can therefore

be regarded as purely mechanical appliances and as integral parts of the machine tools. They are designed primarily for grinding machines, but may be transferred to certain applications on millers, shapers, and lathes. They are also of great value on the bench for scraping, marking out, and rapid assembly work.

A half-turn of the flux control lever renders the work-holding surface either energized or de-energized. This is accomplished by displacing the permanent magnet unit relative to the pole pieces with a simple eccentric movement.

All inner poles on the chuck face are of similar polarity, and the top plate forms the outer pole of opposite polarity. By this arrangement, all the magnets in the chuck can concentrate their magnetism on any work-piece bridging the poles.

The method of boring holes to dead centers in the lathe with the aid of tool-makers' buttons is greatly facilitated by the magnetic lathe chuck. With the flux control lever placed so that the working surface is partly en-

ergized, enough holding power is provided to prevent the work from falling off the chuck face, but allowing it to be tapped readily into position. When correctly centered as shown by the dial indicator, the flux control lever is turned to the "on" position, and the workpiece is held securely for boring.

#### CLAMPS NOT REQUIRED

A part larger than the chuck face itself can be located, as no clamps or other holding fixtures are required. When using the ordinary face-plate, holding fixtures take up space and delay is often incurred in finding suitable clamps and packing pieces. A recessed hole is provided in the center of the face plate to serve as clearance for such tools as drills and boring bars. Although it may be possible to tap a workpiece out of center with the flux full on, it will not move during boring operations. The stresses produced in these two instances are entirely incomparable, and should not be confused.

THE END

## Machine Speeds Precision Grinding of Diesel Fuel Injection Valve Seats

**COOPER-BESSEMER** Corporation's need for a fast method to replace the hand-lapping of needle valves and valve seats in the fuel injection system of Diesel engines was not answered in a readily available grinder of sufficient accuracy, so a machine was designed and made in the company's development laboratory.

Carl Mahaffey, development engineer for Cooper-Bessemer, has designed and completed the construc-

tion of this grinder after many months of experimentation. The performance of the grinder has permitted turning out valve seats in quantity, and with such precision that hand lapping is unnecessary.

The machine is powered by two air motors, one to drive the grinding tip and one to revolve the valve seat.

The illustration shows the motor for driving the grinder mounted at the angle of the seating surface of the

valve base. The motor for driving the valve seat is enclosed and can be identified by the top-plate fastened by screws at the left.

The valve seat is held beneath the knurled chuck which lies immediately in line with the grinder shaft, and is turned in the opposite direction to the grinding motion.

The driving air motor is of conventional design, and is lubricated by a filter feed attached to the air line. The compressed air connection can be seen, center-left, on the air filter which is mounted in series with the oil filter.

Another unusual feature of the Cooper-Bessemer valve seat grinder is the dressing tool unit which is part of the machine base. The photo shows the diamond dressing tool in position for swinging around into contact with the grinding tip.

This production tool is important since the fuel injection system constitutes the heart of Diesel performance, and anything improving dependability and accuracy in fuel injection improves overall efficiency.

THE TOOL ENGINEER



Machine developed by Cooper-Bessemer Corporation for precision grinding of fuel injection valve seats on Diesel engines.

Cooper-Bessemer photo

# Machining Magnesium

## Characteristics, Tools and Lubricants

MAGNESIUM'S CHIEF CLAIM for recognition as a structural metal has long been its remarkable weight advantage. Now, it has become apparent that even where weight does not matter, lower machining costs make its use highly advantageous.

In many instances, the machining costs with the light metal have proved so low that the manufacture of machinery parts from magnesium has been cheaper than from cast iron or steel (see *THE TOOL ENGINEER* March, 1944).

Possessing excellent machining characteristics, magnesium and its alloys can be machined at extremely high speeds; usually at the maximum obtainable on modern machine tools. Heavier depths of cut and higher rates of feed than are used on other metals are possible with magnesium.

The life of cutting tools is very good, especially when using carbide tipped tools. Excellent surface finish is obtained because there is no tendency for the metal to tear or drag. The free cutting action of magnesium produces well broken chips which do not obstruct the cutting tool or the machine. Extremely accurate parts with dimensional tolerances of only a few ten thousandths of an inch can be made by standard machining operations.

The power required to remove a given amount of metal is substantially lower for magnesium than for any other commonly used metal.

Certain physical characteristics of magnesium must be taken into con-

A. M. LENNIE  
MAGNESIUM DIVISION  
THE DOW CHEMICAL COMPANY

sideration in order to avoid minor difficulties in machining. High clamping pressures tend to cause greater springing in magnesium than in most other metals under similar conditions.

For this reason, care should be taken when clamping and chucking magnesium. Extremely heavy depths of cut and feeds are also apt to cause the work to spring. Reamers and taps must be designed to eliminate springing when metal is cut.

### TEMPERATURE CONTROL

The temperatures developed when cutting magnesium are quite low, but the low heat capacity and high thermal conductivity sometimes result in magnesium parts becoming heated during machining if a considerable amount of work is performed. Under such conditions, consideration must be given to the possible thermal expansion of magnesium.

The coefficient of thermal expansion is 0.0000143 for the temperature range of 70° to 200°F. This is approximately equal to that of aluminum and considerably higher than that of steel. An appreciable increase in the temperature of magnesium parts therefore will cause a slight increase in dimensions. Extreme variations in room temperatures will also cause dimensional variations.

The horse power per cubic inch per minute normally required for machining magnesium varies from 0.15

to 0.3. Table A gives the average relative power requirements to machine a number of common metals. The low power required for machining magnesium makes it possible to take heavy cuts at moderately high speeds. It must be remembered, however, that when machining at extremely high rates of speed large quantities of metal are being removed in extremely short periods of time, hence the total power required will be proportionately greater.

Magnesium in all its forms is a free machining metal. Machining chips are usually well broken and do not obstruct the work or cutting tools. The type of chip produced is dependent upon the alloy used, the form and condition of the alloy, and the feed used. Rake angles, cutting speeds and cutting fluids which exert major influences on the chip formation when machining other metals have little or no influence on the form of magnesium chips.

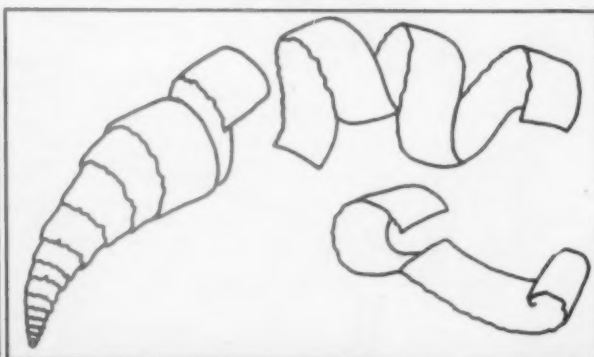
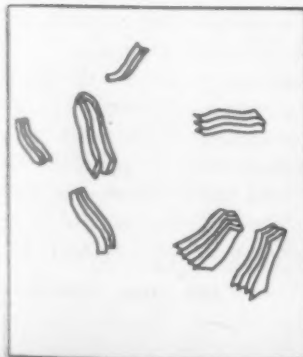
Three general types of chips are produced in turning, boring, shaping and milling. These are illustrated in Figure 1. Cast magnesium alloys usually produce chips of types A and B depending upon heat treatment, while forgings and extrusions produce types B and C depending upon the feeds employed. The greater the ductility and the softness of the alloy used, the more the chips produced will approach type C. As cast and heat treated and aged alloys will tend to give type A chips whereas heat treated and alloys, depending upon the alloy and feeds used, will

FIGURE 1. Magnesium Chip Formation (enlarged 1½ times actual size).

A. HEAVY FEED.

B. MEDIUM FEED.

C. LIGHT FEED.





**PART ONE: Ease and economy of machining magnesium frequently make it the cheapest structural material. Quality finish and production savings may be achieved through utilization of recommended machining practice**

give type B and C chips.

Unlike most other metals, increasing the feeds used in machining magnesium tends to produce shorter and more completely broken chips. Light feeds will produce type C, medium feeds type B, and heavier feeds type A chips.

The ability to take an extremely fine finish is one of the outstanding characteristics of magnesium. It is usually unnecessary to grind magnesium in order to obtain a smooth finished surface. Surface smoothness readings of three to five micro-inches have been reported for finish turned magnesium. Such surfaces are produced at both high and low cutting speeds with or without a cutting fluid.

Standard tools, such as those used for cutting steel or brass, can be used on magnesium alloys; but when taking full advantage of the high cutting speeds and feeds possible with magnesium, tools should be somewhat modified.

The low temperatures and pressures developed in cutting magnesium allow a wide latitude in choice of tool angles, but special attention should be paid to relief and clearance angles.

Relief angles from  $7^{\circ}$  to  $12^{\circ}$  keep the tool flanks from rubbing on the work, and minimize the adherence of chips to the tool. Clearance angles should be larger than those normally used for other metals to provide larger chip spaces.

Best tool life and chip formation are obtained if the rake angles are held from  $0^{\circ}$  to  $15^{\circ}$ . They may be increased if it is desired to reduce tool forces, but some tool life will be sacrificed. Smaller rake angles should be used with carbide tools than with high-speed steel to prevent chipping.

The values for the end and side cutting edge angles are not critical and are best determined by the conditions of the individual job. Extremely large side cutting edge angles should be avoided, however, to prevent chatter. Since magnesium alloys produce a large volume of chips, it is necessary that chip spaces be considerably larger than those used in tools for other metals. This is especially important in drills, taps, reamers and milling cutters.

The nose radii of tools should be relatively small to improve surface finish and prevent chatter.

Carbon tool steels can be used for

finishing tools, reamers, drills, and taps for magnesium alloys. High-speed steel is preferred, however, and is used for practically all drills, taps, and reamers.

Cemented carbide tools should be employed wherever possible, especially on production jobs. The longer tool life secured with carbide tools results in better operating economy, especially at high cutting speeds. The hard abrasion resistant grades of any of the commercial brands of carbide material will work satisfactorily. Cast tungsten-cobalt tool materials will exhibit a tool life between that of high-speed steel and cemented carbide.

The life of high-speed steel tools is improved if the carbon content and hardness are kept high. Surface hardening treatments or chromium plating will greatly improve the life of most high-speed tools used on magnesium alloys.

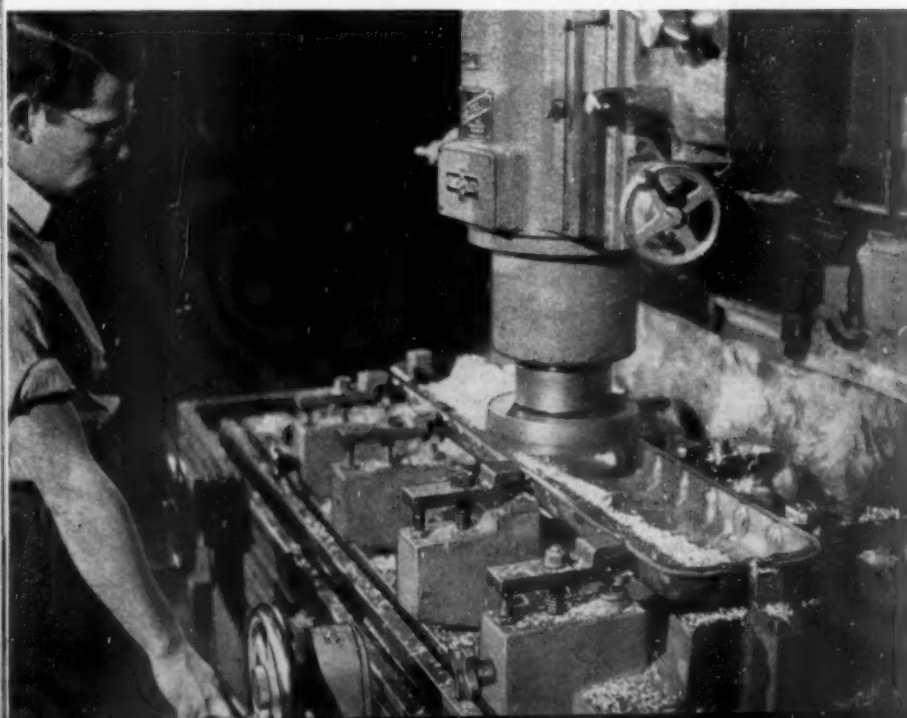
#### **PREPARATION OF TOOLS**

Cutting tools may be rough ground with medium-grain wheels, but finish grinding should be done with fine wheels. Finishing cutting tools with a fine-grain wheel will give smooth tool faces and provide good cutting edges. Aluminum oxide 100-grit wheels are satisfactory for finishing high-speed steel but 320-grit silicon carbide or 200 to 300-grit diamond wheels should be used for finishing cemented carbide tools. Honing and lapping the cutting tool will give very sharp edges, smooth surfaces and improved tool life. This practice may also be used to recondition slightly dull tools.

Since all types of tools should be ground to certain specified angles and have a smooth finish, it is recommended that tools for machining magnesium be ground by a central tool grinding department. Tools should not be run to the full extent of their possible life, but should be resharpened when slightly dull to maintain good cutting edges and conserve tool material. Many shops have adopted the practice of running tools for a definite period, then replacing with freshly ground tools.

Experimental tests and experience in many plants have shown that the purpose of cutting fluids when machining magnesium is primarily to cool the work and reduce the fire hazard. The improvement of surface finish and increase in tool life

**Magnesium is milled at high speeds, often reaching 9000 fpm on face milling.**  
Dow Chemical photo and drawings



that are obtained when using cutting fluids on other metals are of minor importance in the machining of magnesium.

While less heat is generated in cutting magnesium than is the case with other metals, the high cutting speeds, the high thermal expansion, and the low heat capacity of magnesium make it necessary in some machining operations that the heat developed in cutting be dissipated.

Heat may be reduced by correct tooling and machining technique, but is often of such intensity that application of cutting fluids is necessary. The machining of irregular shapes and thin sections which might be easily distorted and multi-tool set-ups which create much local heating are examples of cases where cooling should be employed.

#### SELECTION OF LUBRICANTS

Efficient machining practice demands that high cutting speeds be used wherever possible; and this sometimes results in a fire hazard, particularly when fine chips are produced. Although sharp tools greatly reduce this hazard and cutting feeds must be in the range of .001" and less to start fires, uncertainties in operations make it necessary to take precautions against this hazard.

Iron or steel inserts and sand cast surfaces which are apt to spark when hit with a cutting tool also add to the fire hazard. A stream of cutting fluid, of four to five gallons per minute per tool, is sufficient to practically eliminate the fire hazard. If a particular job or machine tool prohibits the use of a cutting fluid, cutting speeds should be reduced to below 500 feet per minute, and the recommendations regarding sharp tools and feeds rigorously followed.

In all machining operations where a low cutting speed is used, magnesium may be safely machined without a cutting fluid, but safe practice dic-

tates that where high cutting speeds are used cutting fluids should be used.

A wide variety of mineral oil cutting fluids will function satisfactorily on magnesium. Almost any oil will materially reduce the fire hazard if applied in sufficient quantities, but to secure adequate cooling, the cutting oil must have a low viscosity. Since low viscosity mineral oils usually have low flash points, a fire hazard due to the oil is encountered. This fact necessitates a compromise between cooling power and flash point.

Table B presents the range of properties of the most satisfactory cutting fluids. Additives which decrease the surface tension and increase the wetting power of the cutting fluids are beneficial. The chemical nature of magnesium makes it necessary that the free acid content of cutting fluids be below two per cent and that the use of vegetable or animal oils, which may oxidize and increase the acid content, be restricted.

Water soluble oils, oil water emulsions, or water solutions of any kind, although good coolants, should not be used on magnesium. Water will greatly intensify any chip fires which might accidentally be started and also make reclamation of machine scrap very inefficient. The presence of moisture on turnings causes the generation of small amounts of hydrogen which present a definite hazard dur-

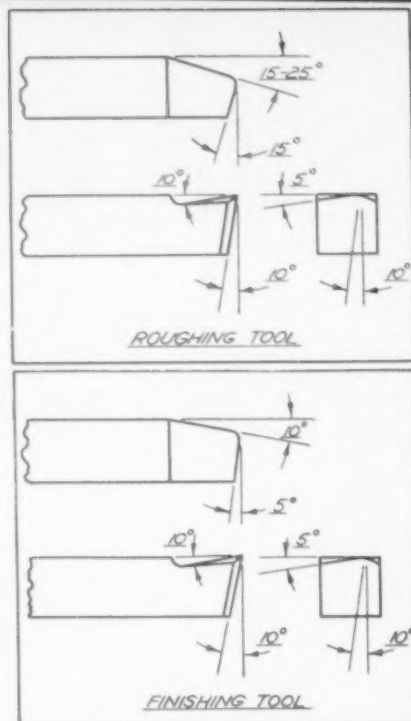


FIGURE 2.

Typical turning tools for magnesium.

ing shipment or storage. Experience has shown that the use of water base cutting fluids on magnesium is dangerous.

Distortion of magnesium parts occurs infrequently during machining and usually is due to heating of the part or to improper chucking.

Heating of the work is increased by the use of dull or improperly designed tools and very fine cuts. The high thermal expansion of magnesium alloys results in an increase in dimensions as a result of this heating. This condition must receive special attention to accurately control dimensions, especially in thin sections where the heat will cause an increase in temperature.

The use of sharp, properly designed tools and relatively large feeds and depths of cut usually prevents excessive heating. An adequate quantity of cutting fluid also will remove the heat developed in cutting and eliminate thermal expansion. Large or massive parts usually have sufficient mass to absorb machining heat without an appreciable temperature rise but wide variations in room temperature during machining will cause excessive thermal expansion.

The fact that magnesium will spring more easily than most metals makes it essential that parts be chucked in such a manner that the clamping pressure is applied to heavy sections and that the pressure is not

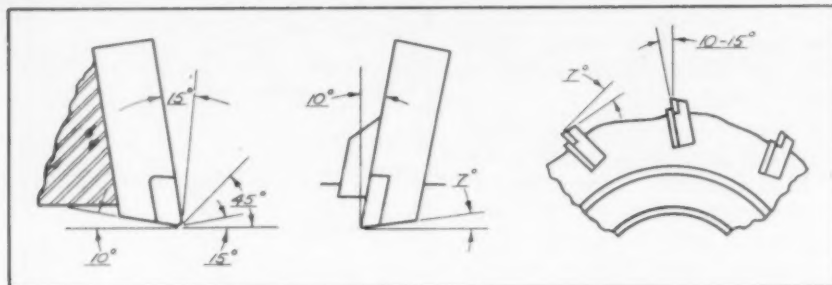
TABLE A.  
RELATIVE POWER REQUIRED  
TO MACHINE METALS

METAL	Relative Power Required (1 = Lowest)
MAGNESIUM ALLOYS	1.0
ALUMINUM ALLOYS	1.8
BRASS	2.3
CAST IRON	3.5
MILD STEEL	6.3
NICKEL ALLOYS	10.0

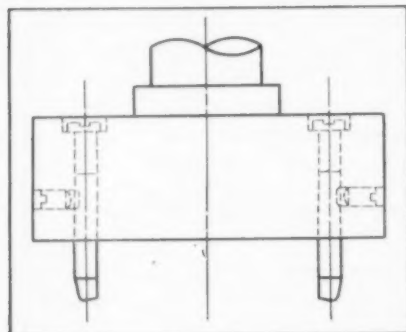
TABLE B.  
PROPERTIES OF CUTTING FLUIDS RECOMMENDED  
FOR MACHINING MAGNESIUM

PROPERTY	VALUE
SPECIFIC GRAVITY	0.79 TO 0.86
VISCOSITY (SAYBOLT) AT 100° F.	UP TO 55 SEC.
FLASH POINT—MIN. VALUE (CLOSED CUP)	160° F.
SAPONIFICATION NO. (MAX.)	16
FREE ACID (MAX.)	0.2%

NOTE: Water soluble oils and oil-water emulsions should NOT be used on magnesium because of fire hazard.



Above: **FIGURE 3.**  
Inserted tooth face mill design.



Left: **FIGURE 4.**  
Two-blade fly-cutter for high-speed  
milling operations.

great enough to cause distortion. Special attention should be given light parts which might easily be distorted by chucking or heavy cuts. Once acquainted with this characteristic of the metal, difficulties can be easily avoided.

Distortion of magnesium parts is seldom due to stresses induced during casting, forging, or extruding; but may be due to stresses caused by straightening of parts. These stresses can be relieved prior to machining by heating at 500°F.

If distortion of parts occurs after rough machining, the size of cuts should be decreased and the cutting tools inspected to insure that they are properly ground and in good condition. These steps usually eliminate any difficulties but it may be necessary to stress relieve or store parts for several days prior to finishing machining. This procedure usually is necessary only on complex parts having extremely close tolerances.

Magnesium alloys must be heated to their melting points before they will ignite. Roughing cuts and medium finishing cuts produce chips of such a size that they are not readily ignited during machining. Fine cuts,

however, produce chips which sometimes will ignite if produced at high cutting speeds. Stopping the feed and letting the tool dwell before disengagement, and letting the tool or tool holder rub on the work will produce extremely fine chips; consequently, these practices should be avoided.

Factors tending to increase the fire hazard are: high cutting speeds, extremely fine feeds, dull or chipped tools, improperly designed tools, and poor machining techniques. With sharp cutting tools, it is necessary to use a feed of less than .001" and cutting speeds in excess of 1000 feet per minute to create a fire hazard.

Even under the most adverse conditions, that is with dull tools and fine feeds, the fire hazard is very slight at speeds below approximately 700 feet per minute. Sand cast surfaces, oxide inclusions, and ferrous inserts which will cause sparks when hit by the cutting tool, increase the possibility of fire.

The use of a sufficient quantity of cutting fluids will practically eliminate any possibility of fire when machining magnesium at any cutting speeds.

The following cautions should be observed to minimize the fire hazards:

1. Magnesium chips and dust should not be allowed to accumulate on the machines or clothing of the operators. Dust and chips should be removed at frequent intervals and

stored in clean, plainly labeled, covered metal cans.

2. Machines and adjacent floor areas should be kept reasonably clean inasmuch as cluttered and dirty floors add to the fire hazards.

3. An adequate supply of recommended fire extinguishers should be within reach of the operators.

4. Smoking should not be allowed in the vicinity of magnesium machining operations.

5. Open flames and sparks must be kept away from finely divided magnesium at all times. Welders should be warned of this hazard.

If a magnesium fire starts, it may be readily extinguished by carrying out the following directions:

1. An adequate supply of recommended fire extinguisher should be placed near each machine where it can be readily obtained by the operator. Several compounds are available which will successfully extinguish magnesium fires.

#### FIRE EXTINGUISHERS

Materials recommended for this use are: G-1 powder; clean, dry, un-rusted cast iron borings; and graphite powder. Sand, talc, and putch can be used on small fires, but are not satisfactory for a large fire, because of the tendency of these materials to break down under high heat.

2. An adequate amount of extinguisher, enough to cover the material with a layer 1/2" deep should be sprinkled over burning magnesium. If there is excessive smoking in spots, more extinguisher should be added to those spots. These instructions can be generally applied to all powdered or granulated materials, but detailed instructions as given by the manufacturers should be followed.

3. Active fires on combustible surfaces should be covered with extinguisher and the whole mass shoveled into an iron container.

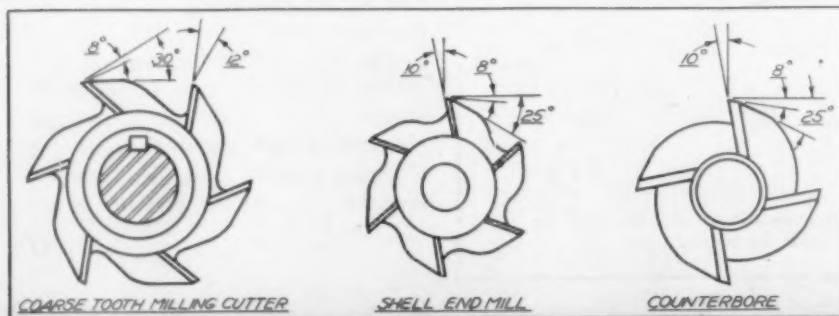
4. Water or any of the standard liquid or foam type extinguishers must not be used inasmuch as they will intensify the fire. Sand, talc, asbestos, aplite, etc., will also accelerate hot magnesium fires.

5. Operators should be instructed in the proper procedure for extinguishing magnesium fires, preferably by means of demonstrations. Signs which call attention to the fire hazards and outline extinguishing procedure should be prominently displayed.

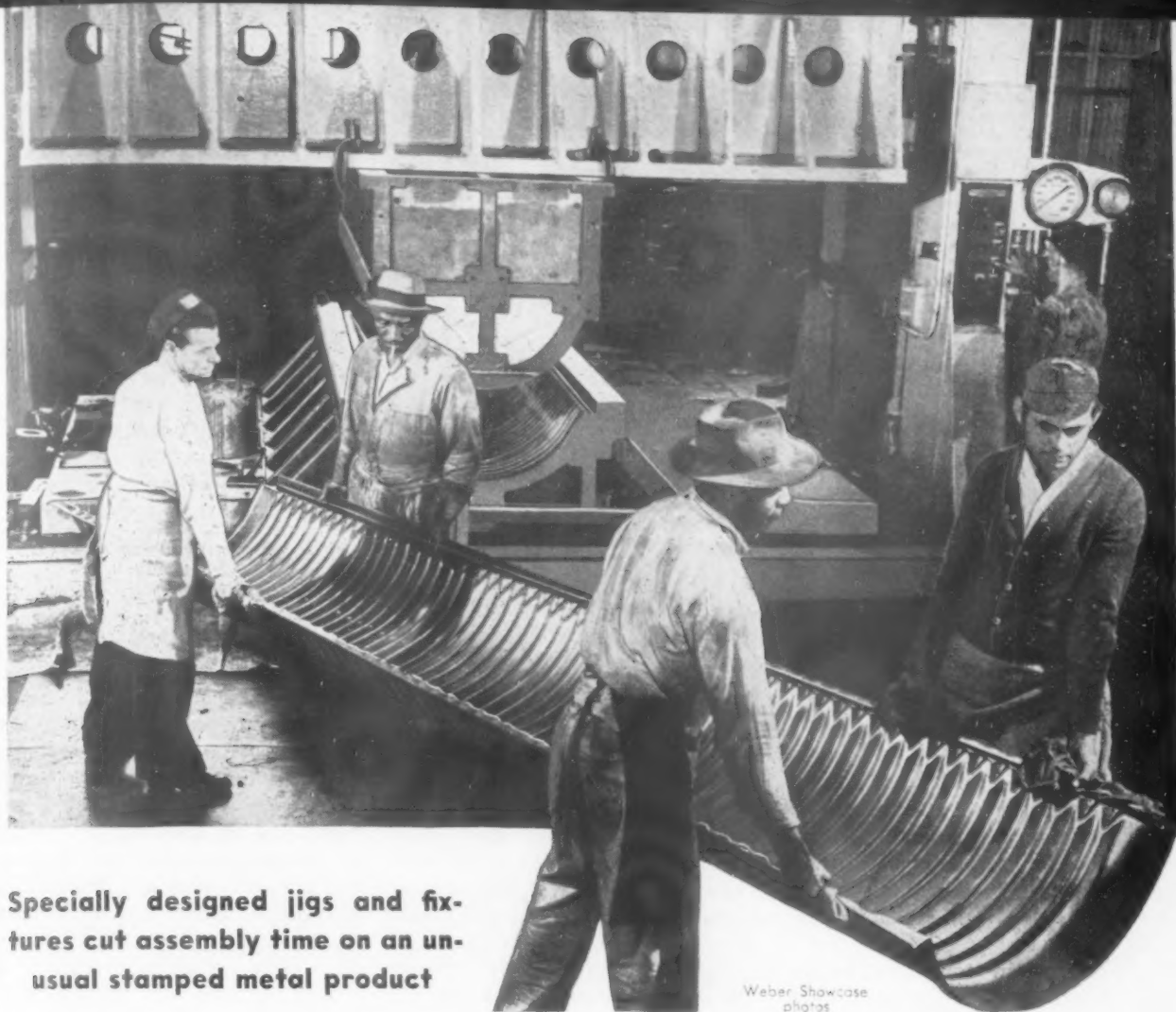
THE END

THE TOOL ENGINEER

**FIGURE 5. Typical cutters and counterbore recommended for magnesium.**







**Specially designed jigs and fixtures cut assembly time on an unusual stamped metal product**

Weber Showcase photos

## **METAL LIFE RAFTS: TOOLING AND PRODUCTION**

**T**OOLING TO MANUFACTURE a new item, particularly when the requirements of war make fast action necessary, frequently taxes manufacturing ingenuity. So it was when the U. S. Maritime Commission invited us to bid on several hundred all-metal compartmented life rafts. Specifications furnished us proved specific as to general performance requirements, but nebulous as to the manner in which the rafts were to be constructed.

In other words, we were told the rafts must carry 20 men and a half-ton of equipment in safety away from sinking ships. How we were to put them together was largely our own problem.

These rafts are all-metal; for safety and strength they are separated into an even 20 airtight compart-

### **GLENN SCHWANDER**

SUPERINTENDENT, METAL DIVISION  
WEBER SHOWCASE  
AND FIXTURE COMPANY

ments, plus a pair of airtight water containers.

Weight figures for an individual raft are as follows: weight empty, 2425 lbs.; twenty men, 3402 lbs.; equipment, 1055 lbs.; total 6882 lbs.

On completion of the contract we will have used 4,607,208 pounds of steel, broken down as follows: sheets and strips, 4,118,232 pounds; bars, 8784 pounds; pipe 472,872 pounds; tubing, 7320 pounds. Also, we will have used 60,024 pounds of brass castings, and 8784 pounds of brass rods. Welding will consume 39,025 pounds of 3/32" dia. rod, while 9750 gallons of baking enamel will be used

to finish them.

Aside from specifications for size and arrangement, which required, among other attributes, that the rafts be either self righting or reversible, that underwater resistance be reduced to a minimum and that four occupants must be able to handle the oars without interference, the most important construction requirements are as follows:

Rafts must be simple and rugged; welding must be done by welders certificated by the U. S. Coast Guard, whose representatives inspect each raft; only approved electrodes may be used; metal shall not be less than 16 gauge; ferrous metal must be protected by galvanizing or other approved means, and two coats of a suitable marine paint must be applied for protection; water and pro-



Hand welding is performed in specially constructed jigs that permit the assembly to be turned for the worker's convenience. Pictured is the nose assembly nearing completion in a jig.

under pressure of 1100 tons at each stroke. For smaller plates requiring corrugating, as the aft plate (6' long) and the two forward plates (each 3'-2" long), the operation is completed in a single pressing. The corner sections, comparatively small and shaped like one quarter of an orange peel, also are stamped in a single operation.

#### CAST FITTINGS ARE STRONG

It is interesting to note that all fittings are cast from manganese bronze steel dies. We will have cast in this manner 84,000 rings, all of which are machine-tapped. The oar locks, so produced, proved to possess five times the tensile strength of sand-cast rings of the same dimensions.

All jigs are similarly constructed of channel iron and pipe. Of these, the side, tail, nose and master jigs are used in the more important assembly processes. The handler, itself a jig, will be considered separately.

**Side jig:** This jig, formed of 3" stand pipe and 4" channel iron, is a simple device. Measuring 32" wide and 11'-6" long, it is reinforced at 32" intervals by cross-cars. These are placed to coincide with the welded joints.

The jig is turned by a worm gear, so arranged that no locking device is needed. Clamping devices, operated by hand levers, hold the metal

vision containers must be integral with or permanently attached to the raft structure, and so arranged that their contents may be removed from either side; and suitable tests must be undertaken during fabrication and after completion.

In preparation for the job, we designed and had made approximately 40 dies, from comparatively small 60-pounders to a male-female combination weighing 14 tons. These enable us to produce the individual parts speedily and accurately. Assembly is undertaken by means of several jigs and a portable handler in which the nearly-completed raft may be rotated to facilitate welding and testing.

**Loading 1055 pounds of equipment in raft before shipment from the plant.**



Most interesting of the dies is the 14-ton unit used to corrugate large sheet of flat 16 gage steel which measure 48" wide by 162" long. These, when corrugated, stiffened and assembled, become the raft's side plates. The dies, made of Meehanite containing approximately 65 per cent steel were cast in sand, matched perfectly by hand grinding, and spotted in.

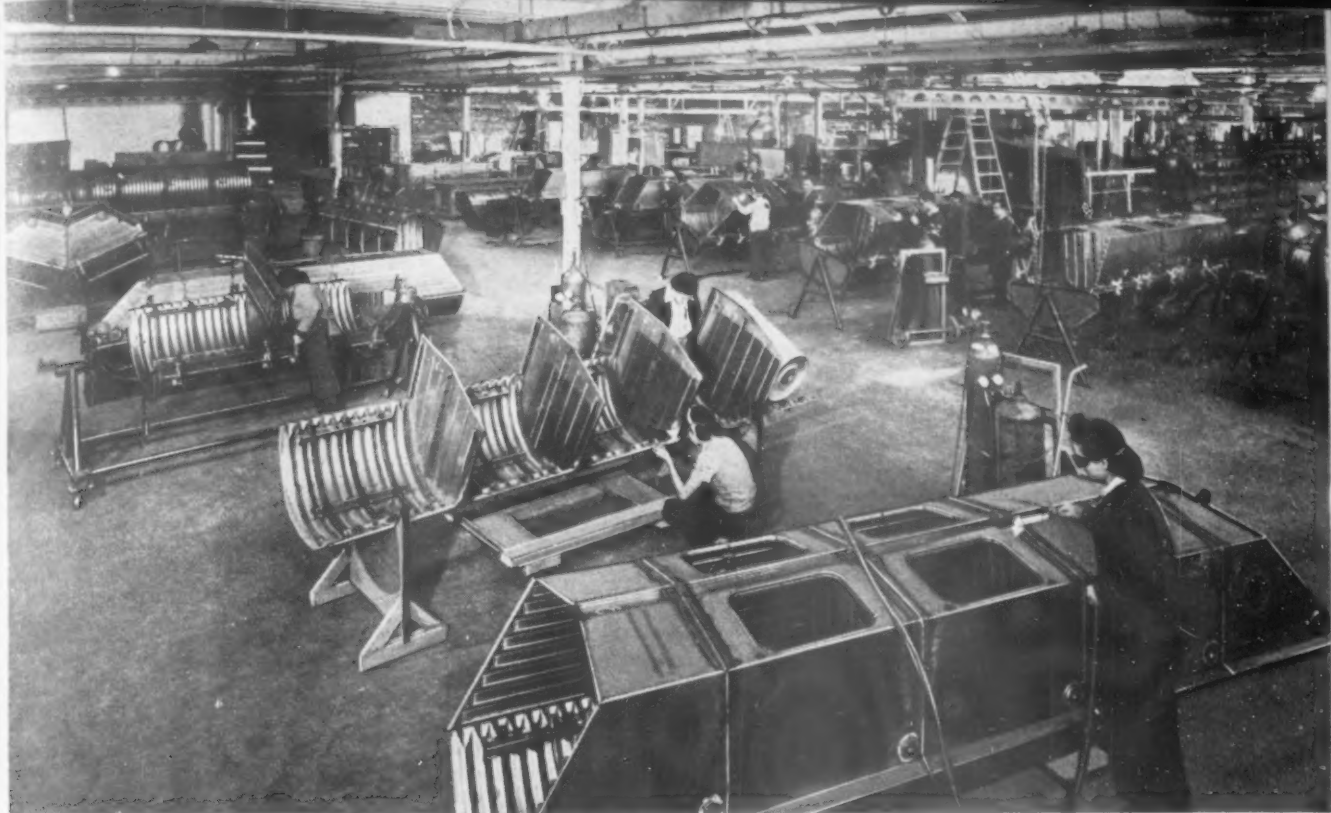
The stamping operation takes place on one of the world's largest deep-draw presses, described in *THE TOOL ENGINEER*, September, 1942, by William Pruitt, Weber experimental engineer. Because the side plates are quite long, the corrugating operation takes place in three passes,

**Coast Guard life raft mounted on Liberty ship launching mechanism.**



**All-metal raft weighs 2425 pounds, carries 20 men, mounts a sail.**





Approaching assembly line production methods, Weber engineers use these stationary welding jigs to hold the side sections of the rafts while the seat assemblies are welded in position.

firmly in place for welding.

**Tail jig:** Except for its length—8'—this unit duplicates the side jig.

**Nose jig:** This jig follows the plan of the tail jig, other than for its V-shape to receive the nose section point-down. The cradle consists essentially of two pairs of longitudinal angle irons and four latitudinal bows. Reinforcing pipes connect all the cross-members at the mid-point.

**Master jig:** Designed to hold the entire weight of the raft rigid while it is tack welded, the master jig embodies a bed made of 4" channel iron, supporting legs and cross-bracing. Seven legs of 3" stand pipe are provided, three on each side and one under the nose. The channel iron forming the bed runs completely around the top of the legs, and is welded into place. Three cross braces at equal intervals hold the bed in line, while a fourth extends from the nose to the back of the girder. Each pair of legs is braced.

A supplementary jig, atop the master jig, carries hand operated lever clamps by which the sides, nose and tail are held firmly together while the raft is tack-welded together across both top and bottom. "Orange peels", previously attached to the ends, are tack-welded to the sides in the master jig.

**Handler:** Though simple in design,

this fixture not only holds the raft horizontally but also permits it to be revolved to facilitate welding and testing. It is made of 3" pipe, the end assemblies being held together by two pipe stringers.

Prior to leaving the master jig, a circular pipe is fastened to the nose of the raft and an arm-like attachment to the aft end. When lowered by crane into the handler, the plate rests on two roller bearings, and the arm fitting into the rear bearing section. Thereafter, workers may move the raft horizontally and laterally by pushing the jig around on its four casters, and revolve the raft in its bearings. A pin locking device stops the raft at any desired angle.

#### SUB-ASSEMBLIES ARE BEGUN

Simultaneous with stamping operations, units which eventually form the raft are sub-assembled. Seat sections are formed and reinforced with a corrugated stiffening member, spotwelded in place. This is an unusually important operation, for these seat members must withstand the impact of a long, flat drop into the sea, without buckling or breaking.

Drain flanges are pressed on by heat induction, a process that requires only 31 seconds in the presence of 20 kilowatts of heat, on 10,000 cycle current. Meantime, other work-

ers are silver-brazing drain flanges to the seats, this metal-to-metal procedure replacing orthodox gasketing to make certain the seals remain permanently.

To facilitate later installation of flooring, this unit is prefabricated in sections. Water tanks, accessible from both ends, are seam welded from 12 gauge cold rolled steel plates 33" x 45" in size to form single tubes. Stamped heads are rotary seam welded. After the cover flange for the openings are bolted on and rubber-gasketed to make them watertight, the tanks are dip galvanized.

Following the completion of these minor units, sub-assembly begins. As the first step, the side skin is placed in the side jig already described and clamped firmly in place. Four vertical bulkheads are lowered into the same jig and gas-welded into the inside of the side plating.

Here, one of the first tests takes place. Phosphorous paint is spread over the non-welded side, and the welded side examined under a magnaflux lamp. If no tell-tale luminous violets appear under the lamp, the seam is tight enough to repel even gasoline.

Now the water tanks are installed in the rear side sections. At this time, too, curved pipe stiffeners are welded into the curved side of the



skin, seat sections are welded into position, and the section again tested for leaks. A seam welder fabricates the edges of the entire assembly into a leak-proof seam.

Following another leak test, the assembly moves to the master assembly jig, where the 14 vertical bulkheads are welded, and tested once more. This assembly welding completed, the floor frame is installed, being welded in place along the exact center line. A double floor permits smooth footing no matter which side of the raft strikes the water.

When the tack welding is completed, the raft is removed by crane to a handler, where floor supports are welded in, the floor installed, and thwarts, oar locks, stanchions, clips, spray curtains, grab rail supports and grab rail are attached. The raft is now complete, except for final testing and finishing procedures.

Each compartment undergoes rigid testing, for it must remain watertight under all sea conditions. This procedure is accomplished by means of a water column and air under pressure of one pound psi. Should a leak develop, the water level would drop. It's a simple and positive test, and is conducted under supervision of the U. S. Coast Guard.

#### PROTECTION AGAINST SALT

At this stage, a raft can save as many lives as one which has been further processed, but its life in the presence of salt air would be short. Accordingly, it is rustproofed by Parkerizing. Following rust-proofing, the raft is drained, cold-water rinsed and drained a second time, drying being quickly accomplished in a special tunnel lined with infra-red lamps. Now it is primed in a zinc chromate solution, and again drained;

sprayed with two coats of Navy gray, and dried by infra-red; and removed from the handler.

At intervals, a finished raft is selected for drop-testing. For this purpose, the unit is dropped from a height of 45' into deep water. We have no fear of the results, for the first raft constructed was subjected to this rigorous treatment, three times—flat, on end and on the side. It withstood the severe beating without failure.

The rafts leave the Weber plant in Los Angeles ready for service. Into the four amidship compartments we pack more than a half-ton of supplies. These include foods, storm oil, distress signals, for use day or night, fishing kits, blankets, signaling mirrors, wood plugs with which to fill bullet holes, oars, spray curtain, storm canopy and a 100 square foot sail.

THE END

## Quick Change Drill Chuck Assembly for Stack Drill Machine

**A** QUICK CHANGE drill chuck assembly and special automatic controls of the power, lubrication feed and air flow, incorporated on a Hi-cycle stack drill machine, have been designed at the St. Louis plant of Curtiss-Wright Corporation by Harry McMurty Griffin of the Tool Research and Development Department.

Drills, which are changed from two to four times on each stack that is drilled, are installed or removed without the use of tools, and can be changed while the motor is running and the air and lubricant are turned on. As

much as 87 per cent of the time formerly required to change drills and bushings is saved.

The chuck assembly, which combines the drill and drill bushing into one unit, comprises a plug for holding the drill, enclosed in a housing. The lower end is a flame-hardened tip which acts as a drill bushing. The upper end of the plug engages a mating part that is secured in the standard drill chuck.

Two brake drums are attached to the hinges of the jack knife drill arms on the machine. A spring actuated

brake shoe holds the arms in position. An air-operated cylinder releases the brake when pressure is applied.

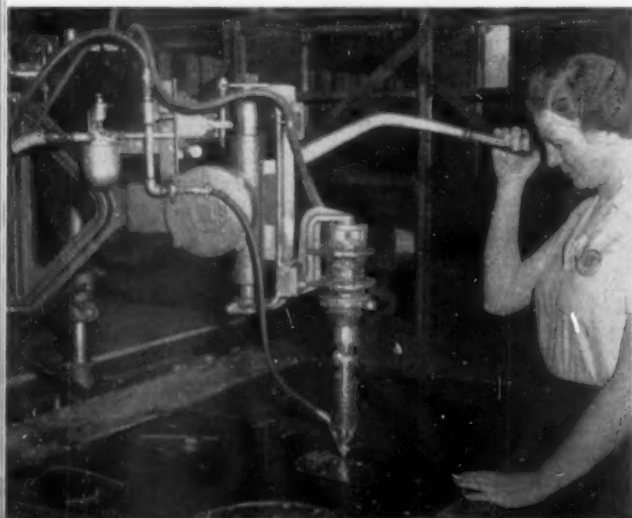
The air flow to the lubrication feed, the air line which removes the chips, and the brake release cylinder are all controlled by an air valve, which is opened by the first movement of the operating handle. An electric switch, which controls the motor, is also actuated by the operating handle.

Prior to installation of the brake assembly, the equipment moved out of reach of the operator when the operating handle was released. It is now frictionally held by the brakes in the position where it is released by the operating handle.

The automatic oiler is attached to the input of the main valve. The air supply is impregnated with oil prior to entering the main valve and the hose line is positioned so that the mixed air and lubricant are fed directly into the drill and bushing assembly. The brake cylinders are actuated by the air line through the main valve.

The operating handle works in a vertical plane and, when released, it moves upward, closing off all air and electric supply.

THE END



Stack drilling machine in operation. Drill and bushing are combined into one unit in the drill chuck assembly.

Curtiss-Wright photo

# Increasing Production Efficiency With Tool Life Tests

## L. L. THILL

GENERAL SUPERINTENDENT  
McQUAY-NORRIS MANUFACTURING COMPANY  
ORDNANCE MANAGEMENT DIVISION

## E. B. FREMON

LUBRICATION ENGINEER  
SOCONY-VACUUM OIL COMPANY

**M**ODERN MACHINE SHOPS have shown, during the war, the tremendous production increases possible by concentrated efforts to utilize fully the latest improvements in methods and materials affecting the production of metal parts.

During the past few years, the practice of running tests to determine whether one method, tool, steel, or other production factor is better than another has become common. In some cases it has been practical to set up laboratory tests similar to the production procedures involved in order to check a proposed change under carefully controlled conditions.

In the majority of cases, however, it has been necessary to run the tests on machines in regular production. These tests on production equipment necessarily involve more variations in test procedure and results than those made under laboratory conditions.

### TESTS ON STANDARDIZED PARTS

Tests on automatic machines—particularly on automatic screw machines—are usually made on production units. As a result of a great many tool life tests, made on automatic screw machines making armor-piercing bullet cores, some interesting data has been assembled on the accuracy of such tests and the conditions which must be met in order to get test results which will give a good estimate of probable performance in actual production over long periods of time.

When the core-machining section of the St. Louis Ordnance Plant was placed in operation, with several hundred automatic screw machines as the production machining equipment, it was realized that the possibilities for waste by using inefficient methods were tremendous.

A definite policy was set up by the McQuay-Norris Manufacturing Com-

pany, operators of this section of the plant, regarding the search for better methods. It was decided that as ideas for improvements were presented, tests would be run on a few machines to determine whether the proposed idea had merit, leaving the majority of the machines operating in the manner found most efficient up to that time. Such tests have been carried on continuously, with improvements in results being secured by adopting methods which proved better than those originally used.

This plant was one of the first to use large numbers of automatic screw machines on standardized parts over a long period, and thus provided an opportunity never before available for correlating test results with production operation.

One of many tool life tests made on this job consisted of a run on 38 automatic screw machines over a period of 30 shifts of eight hours each during ten days. This test was made to try out a new cutting oil formula, and the test conditions were intended to duplicate actual production conditions as closely as possible. The machines were in production at the time of the test, the only difference between the test machines and regular production machines being that accurate records were kept of the tool life on the test machines, as described later.

The test set up was as follows:

● **MACHINES:** Thirty-eight 9/16" Model RA-6 Acme Gridley, six-spindle automatics, built by the Na-

tional Acme Company, Cleveland.

● **TOOLS:** 18-4-2+8 high speed steel, hardened to Rockwell C61-63, ground all over. Each machine was provided with four sets of tools which were matched within .0001" in all dimensions, so that one tool could be replaced by another without adjustment of tool holders.

● **MATERIAL:** FXS-318 Manganese molybdenum steel, hardness about Rockwell B-100, spheroidized structure. All the steel used during this test was from one mill.

● **PART:** Caliber .50 armor-piercing bullet cores.

● **MACHINE SETUP:** Surface speed, 125 fpm on .453" diameter bar. Forming operations done at .0013" per revolution feed, endworking tools at .00514" per revolution feed. The machine is equipped with pick-off attachment for deburring at cutoff. Cycle time is 4.3 seconds.

The coolant used was a light-bodied sulfurized oil containing added fatty materials. Coolant from the test machines was reclaimed in a system separate from the production cutting oil.

The term "tool life" as used here means the number of pieces run before a change of one or more tools was required because of poor finish or inaccuracy of dimension in the finished parts. When one tool required changing, the whole set of seven tools was replaced with another set. In other words, the life of a set of tools was actually the life of the shortest-lived in the set.

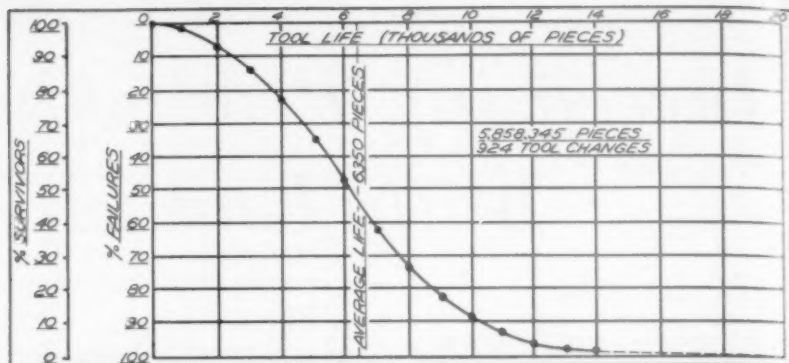
● Here is an unusual report on the results of a large-scale tool life test conducted on automatic screw machines in actual production. Stressed by the authors is the fact that under identical test conditions, wide variations in results occur.

The data assembled indicate that accuracy of results depends upon the number of tool changes in a test. Illustrated is a method for determining how many tool changes are necessary to secure data of desired accuracy.

Highlight of the report is the fact that data on the life expectancy of cutting tools may be useful in setting up production operations for greater efficiency and lower costs.

**FIGURE 1.**

Life expectancy of tools as indicated in an analysis of tool life tests made on automatic screw machines. The points on the curve were obtained by determining the percentage of failures occurring at less than a given number of pieces, then subtracting from 100 per cent to give the number still running at the given number of pieces.



The tool changes were made by experienced setup men, stock-feeding and minor tool adjustments being done by the machine operators, who were considered of average experience.

It is believed that this test was run under as nearly constant conditions as can normally be expected on production machines.

An overall average of 6350 pieces per grind on the shortest-lived tool, secured in the total of almost 6000,000 pieces, in more than 1000 machine shifts, and with more than 900 tool changes, represents very closely the performance which might be expected during a long period in actual production. This overall average of 6350 pieces is referred to later as the "true" average.

An extremely wide variation occurred in the tool life figures for each machine. The total range was from 89 pieces in one machine to 18,900 pieces in another. Also, the averages for the different machines varied.

#### ANALYSIS OF TEST DATA

The data was analyzed from the standpoint of the number of tool failures at a given life, since this is a significant item in production. The result of this analysis is shown in the accompanying graph, (Figure 1). The points on the curve were obtained by determining the percentage of failures occurring at less than a given number of pieces, then subtracting from 100 per cent to give the number still running at the given number of pieces.

In other words, the curve shows that if 1000 sets of tools, for example, were put into machines under the conditions of this test, at 1000 pieces tool life, 990 sets of tools would still be good for further production; at 2000 pieces tool life, 930 sets would still be good for further production; at 6000 pieces tool life, 510 sets would still be good.

It is important to remember, in connection with this life-expectancy

curve, that as nearly as possible under production conditions, all these tool life tests were run under identical conditions. The curve illustrates that in order to get a satisfactory estimate of tool life when running tests on production machines, a very large number of tests must be run.

Observations concerning the accuracy obtained are interesting. If one test, comprising about 100 tool changes, is run on a group of four machines, the chances are about 16 out of 100 that the average secured would be more than 10 per cent different from the true average, and there would be about one chance in 38 of having data 22 per cent different from the true average. With one group of ten machines and about 250 tool changes, the chances would be about 87 out of 100 of having data within 5 per cent of the true average, and the maximum error would not be likely to exceed 8 per cent.

This data applies strictly, of course, only to the particular machines and operation performed, and to the particular conditions existing in this plant. We believe, however, that similar data will be secured on any series of tool life tests.

For any plant where conditions remain fairly constant, it should be possible to determine the test setup which will give data of any desired degree of accuracy. For this particular plant, for example, the data shown leads to the conclusion that for reasonably accurate results, at least 250 tool

changes are required.

We believe the method of analysis shown in Figure 1 is of great importance. Such an analysis of tool life data, for example, would be of value in determining the most economical performance range of expensive tools.

The degree of control of all variables will be shown by the slope of the life expectancy curve. Perfect control would show all tool life figures nearly the same, or nearly a vertical line on the graph. The less the slope of the curve, the less perfect the control of variables, and hence the smaller the chance of economical operation.

#### REDUCING TOOL FAILURES

As an example of the use of such curves, the data plotted in Figure 1 was used to confirm the advisability of changing tools on a regular schedule. It was felt that if tools were changed at the beginning of each eight-hour shift, more economical tool life and greater production would be secured. The curve shows that at a production of 5400 pieces (80 per cent of theoretical) per eight hours, only 40 per cent of the machines show a tool failure.

In other words, of 100 sets of tools made up of 700 individual tools, only 40, or about 6 per cent would fail in less than eight hours. This was considered economical in terms of tool cost. In terms of machine time, this practice was also economical, since only 15 minutes were required to change a complete set of tools.

Of 100 machines, 60 could be expected to run 7¾ hours out of eight, while 40 would be down for a few minutes to change individual tools. This practice, therefore, derived maximum time value from setup men.

Any attempt to run each set longer would mean a greater proportion of tool failures before the scheduled change, resulting in loss of machine time, and at the same time would result in more burned tools. **THE END**

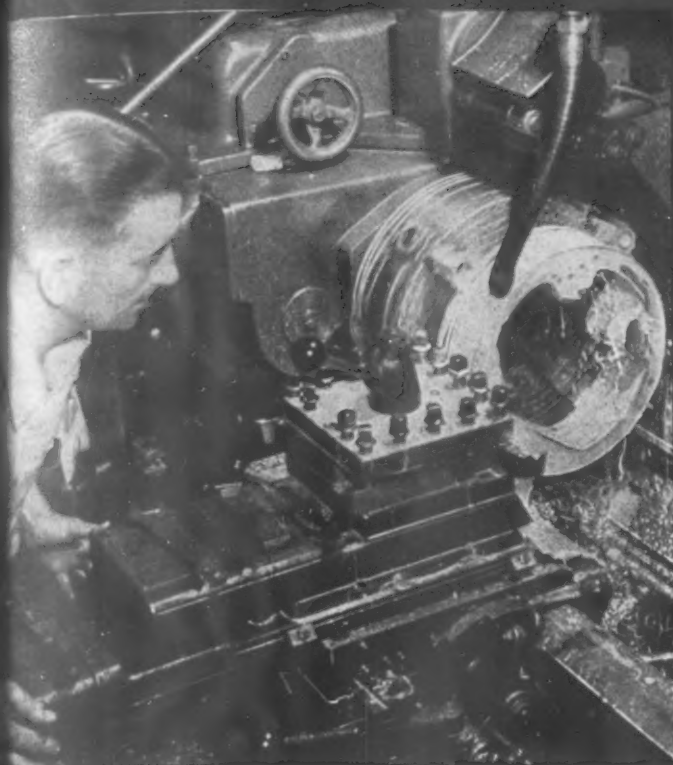
#### CREDITS

• Few production setups permit compilation of the unusual tool life test data presented by the authors of this article. The tests, made on 38 machines during 30 eight-hour shifts, represent many hours devoted to checking and machine-record analysis.

The authors wish to express appreciation for the assistance they received, particularly from C. H. Ross, Tool Supervisor, McQuay-Norris Manufacturing Company, Ordnance Division; G. C. Hazard and J. T. Beard, Socony-Vacuum Oil Company; and Lt. Col. G. V. Riley, Commanding Officer, St. Louis Ordnance Plant.

—THE EDITORS





## If It's a Warner & Swasey, it's a HIGH PRODUCTION PRECISION MACHINE

**W**ARNER & SWASEY, for many years builders exclusively of turret lathes and turret lathe tools, has added a line of precision tapping and threading machines.

There's a sound reason for this step. Emphasis throughout this war period is big volume production of machined parts produced at high speed and held to unusually close tolerances. Greater accuracy in internal and external thread cutting has been demanded by Army and Navy for war materiel. The demand for quantity production and closer machining limits will carry over in postwar manufacture of civilian goods.

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because of thread deficiencies means the loss of time, critical materials, and the skilled effort that has gone before.

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# PRODUCTION DATA SHEET

## ECONOMICAL LOT SIZES

**"H**OW MANY PIECES shall there be in a lot?" Commonly, the shop insists that only "large" lot sizes are economical. But, the "front office," cognizant of the risks involved, and not subjected to the pain of difficult setups, is apt to request "small" lot sizes.

To reduce controversy with facts and figures, formulas have been developed to determine practical manufacturing lot sizes. Ease of solution should encourage their use. Their application to individual problems will enable production engineers to state specifically the smallest practical lot size.

FORMULA 1 GIVES the total cost per piece for any number of pieces per lot. Formula 2, though not bearing directly on the problem, is part of the derivation of the other formulas. Formula 3 gives the lot size required for an absolute minimum cost per piece.

Formula 4 is used to determine practical lot size. In a majority of cases, it is the only formula requiring solution. Much reduction of the quantity indicated by this formula results in a sharp rise in cost per piece. Increased quantity does not lower cost per piece appreciably. The results of Formulas 3 and 4 may be considered as the high and low limit of lot size.

Although cost per piece does not rise prohibitively when the lot size is beyond the high limit, there is no advantage in increasing size. Of course, for bulky materials, the increase might result in great disadvantage.

THE SMALLEST economical lot size may be desirable for the following reasons:

1. Lack of equipment making frequent setups necessary
2. Demand for completed assemblies prohibits long runs

3. Apprehension concerning accuracy of specifications, tools, and methods demands physical tests on lots of smallest economical size.

On the next page, a curve, based on Formula 1, is plotted according to indicated values, showing pieces required in one lot to give minimum cost per piece, and the number of pieces in practical lot size.

### DERIVATION OF FORMULAS

1.  $Y_p$  = Total cost per piece (\$).
2.  $Y_d$  = Total cost of one day's requirements (\$).
3.  $X_m$  = Number of pieces in one lot to give a minimum cost per piece.
4.  $X_p$  = Number of pieces in practical lot size (where the slope of the curve =  $-.05$ ).

Let  $M$  = Manufacturing cost per piece: Labor + Material + Overhead only.

Let  $R$  = Interest + Depreciation + Insurance. For round figures, a value of .073 (7.3%) is assumed as a good approximation.

Let  $N$  = Number of pieces required per day.

Let  $S$  = Cost of Setup + Cost of Issuing Order + Loss of Profit During Setup. Tool Design and Tool Making may be considered in this item.

$$Y_d = NM + \frac{NS}{X} + \frac{RMX}{365 \times 2} + \frac{RS}{365 \times 2}$$

$$Y_d = NM + \frac{NS}{X} + \frac{.073 MX}{730} + \frac{.073 S}{730}$$

$$Y_d = NM + \frac{NS}{X} + \frac{MX}{10,000} + \frac{S}{10,000}$$

$$Y_d = \frac{NS}{X} + \frac{MX}{10,000} + \frac{10,000 NM + S}{10,000} \quad (2)$$

$$Y_p = \frac{S}{X} + \frac{MX}{10,000 N} + \frac{10,000 NM + S}{10,000 N} \quad (1)$$

Differentiating Equation (1):

$$Y_p' = -\frac{S}{X^2} + \frac{M}{10,000 N}$$

Equating to zero, and solving for  $X_m$ :

$$X_m = 100 \sqrt{\frac{NS}{M}} \quad (3)$$

Setting the derived Equation of (1) = to  $-.05$ , and solving for  $X_p$ :

$$-\frac{S}{X_p^2} + \frac{M}{10,000} = -\frac{5}{100}$$

$$\frac{S}{X_p^2} = \frac{M}{10,000 N} + \frac{5}{100}$$

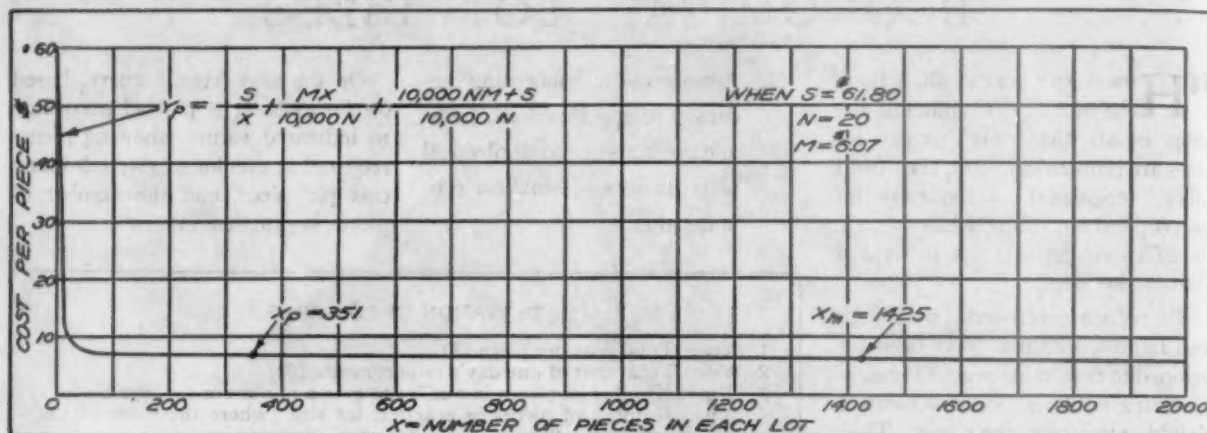
$$\frac{S}{X_p^2} = \frac{100 M + 50,000 N}{1,000,000 N}$$

$$X_p = 100 \sqrt{\frac{100 NS}{M + 500 N}} \quad (4)$$

NOTE: This is the thirty-third of a series of Data Sheets to be published in THE TOOL ENGINEER. A handy three ring binder can be secured at any dime store to hold the sheets for quick reference.



# ECONOMICAL LOT SIZES



● CURVE, based on Formula 1 from preceding page, is plotted according to indicated values. S equals cost of setup plus cost of issuing order plus loss of profit during setup. Tool design and tool making may be considered in this item. The curve shows that the number of pieces in a practical lot is 351, at the values indicated. This means that between practical lot size, and the lot size giving the absolute minimum cost per piece, there is a reduction of only .05 in unit cost. Minimum cost is indicated at lots of 1425.

$$Y_p = \frac{S}{X} + \frac{MX}{10,000N} + \frac{10,000NM + S}{10,000N}$$

X	$\frac{S}{X}$	$\frac{MX}{10,000N}$	Yp
1	61.80	.00	67.87
5	12.35	.00	18.43
10	6.18	.00	12.25
25	2.47	.00	8.54
50	1.23	.00	7.30
100	.62	.00	6.69
200	.31	.01	6.39
300	.21	.01	6.29
400	.15	.01	6.23
500	.12	.02	6.21
1000	.06	.03	6.16
1500	.04	.05	6.16
2000	.03	.06	6.16

S = \$61.80      N = 20      M = \$6.07

● TABULATION for the curve based on Formula 1 gives costs for lot sizes shown. Through the use of the formulas on the preceding page, production engineers can show similar tabulations to determine practical lot size for any job. Costs of smaller lots than practical are readily available for evaluation in the light of marketing, or other risks which may be involved. At the same time, the manufacturing department need not ask for sizes sometimes described only as "large," in an effort to amortize tooling or other investment.

# THE CRIB

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

IDEAS • KINKS • SHORT CUTS

## Adjustable Fly Cutter

TO EASILY and economically cut openings in cast iron frames, one manufacturer of textile machines has developed an adjustable fly cutter made with a machine steel body "A", the shank being machined to fit the chuck or collet of a drilling machine.

Three slots are machined in the body so that the cutting blades "B" make a sliding fit. Notches are milled in the body to provide convenient access for adequate headless screws. A machine steel plate "C" is fastened to the tool body with special fillister head machine screws.

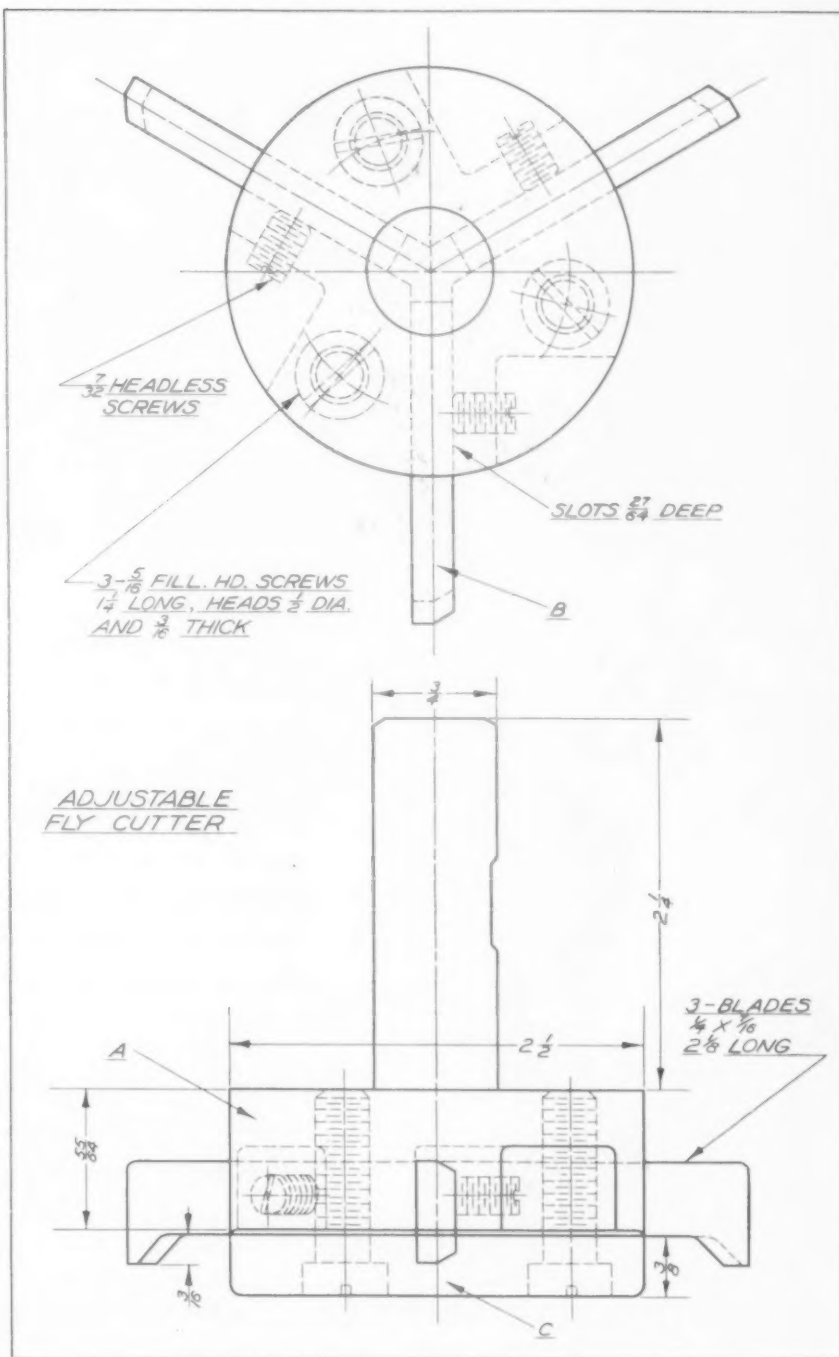
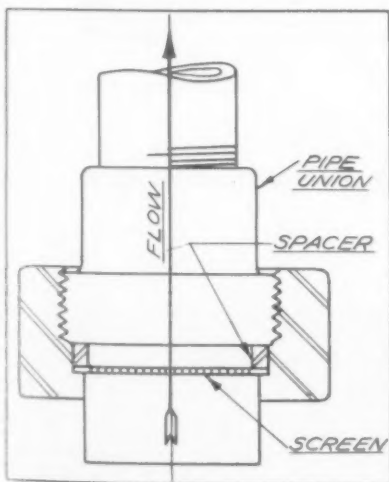
To adjust the cutter blades for a required size hole, the fillister head screws are loosened, releasing the clamp plate "C" from the cutter blades. These may now be adjusted by means of the set screws to the desired size of hole.

When adjusted, the fillister head screws are tightened, forcing the plate "C" against the cutter blades. This holds them securely in position, and produces a rigid fly cutter suitable for machining holes up to the capacity of the length of the blades.

This tool may be used on steel, brass, sheet iron or any other material by changing the contour of the cutting edges of the blades.

## Strainer for Coolant Lines

A VERY SIMPLE and effective strainer for coolant or hydraulic lines can



be made from a pipe union as illustrated in the accompanying drawing at the left.

In place of the conventional gland, a screen locked with a ring-spacer should be substituted. The screen in this coolant filter can be cleaned quickly and replaced easily.

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# MEN • MATERIALS • MACHINES

## FIRE PROTECTION

### IN THE METAL-WORKING INDUSTRY

**WILLIAM H. EASTON**  
SAFETY RESEARCH INSTITUTE

**P**RODUCTION AND FABRICATION in the metal-working industry involves use of a number of serious fire hazards, including high-temperature ovens and furnaces, explodable gases, cutting and welding torches that scatter showers of sparks, highly flammable solvents and finishes, and a variety of combustible oils for lubricating, tempering and cutting.

Knowing how to use these tools safely is an important, but neglected, phase of metal-working. Accidents happen to the most expert. To cite but a few items from records compiled by the National Fire Protection Association, the following mishaps were responsible for fires costing lives or large property losses in the metal-working field last year:

#### AVOIDABLE TROUBLE WITH FIRE

A spark from a welding torch fell into the unplugged opening of a benzol drum.

A hydrogen tank exploded.

Magnesium castings were placed in a bath of molten nitre intended for aluminum.

A forge ignited an oil-soaked floor. Water from the electrode-cooling system of an electric furnace poured into molten metal.

Creeping fumes from a gasoline spill were ignited by a welding torch.

Hot chips from a machine tool fell on combustible material.

These things should not have happened, but they did; and similar accidents must be expected wherever hazardous processes are being carried on, particularly during the war when quickly trained people are found in every department. It is, therefore, important to safeguard such places with an especially effective system of fire protection.

An example of an effective system of fire protection in the metal-working industry is that developed about two years ago to cut losses in the large Milwaukee factory of the Kearney & Trecker Corporation.



Caterpillar Tractor photo

Accidents must be expected wherever hazardous processes are carried on, particularly in plants where large numbers of new workers are employed. Sparks from welding frequently cause serious fires in the metal-working industry.

Outstanding among industrial fire protection systems is that in the plants of Kearney & Trecker Corporation. In every department, a fire brigade of six to eight specially trained workers is ready to attack any fire that may occur.

Kearney & Trecker photo



Since this system was adopted, more than 300 fires have broken out in the company's plant, in spite of rigorously maintained fire prevention measures; but every fire has been extinguished so quickly that none caused enough damage to warrant a special report on the subject.

Here's how the system works:

When a fire breaks out in any department of the plant, regular workers on the spot immediately attack it with hand fire extinguishers, as every man in the plant has been trained in the use of these devices.

Often, the workers put the fire out

# STANDARD APPROVED HAND FIRE EXTINGUISHERS FOR USE IN THE METAL-WORKING INDUSTRY

Type of Extinguisher	Contents	To release Discharge	Protection Required Against Freezing	Recharge	APPROVED FOR USE ON		
					Class A Fires* (wood, paper, cloth, etc.)	Class B Fires* (flammable liquids, oils, lacquers, etc.)	Class C Fires* (live electrical equipment)
Soda Acid	Water and chemicals	Turn over	Yes—never add anti-freeze chemicals	Annually, and after use	Yes (cooling)	No	No
Foam	Water and chemicals	Turn over	Yes—never add anti-freeze chemicals	Annually, and after use	Yes (cooling and smothering)	Yes (smothering)	No
Gas Cartridge	Plain water and CO <sub>2</sub> cartridge	Turn over and bump on ground	Yes—anti-freeze chemicals may be added to water	After use	Yes (cooling)	No	No
Loaded Stream	Water, chemicals, CO <sub>2</sub> cartridge	Turn, bump on ground	No—(may be exposed to —40° F.)	After use	Yes (cooling)	Yes (action is not understood)	No
Vaporizing Liquid	Specially processed carbon tetrachloride	Hand pump for small sizes; valve for larger	No—(may be exposed to —50° F.)	After use	**	Yes (smothering)	Yes (non-conductor of electricity)
Carbon Dioxide	Carbon dioxide under pressure	Turn valve	No	After use	**	Yes (smothering)	Yes (non-conductor of electricity)

\*Approving bodies: Underwriters' Laboratories, Factory Mutual Laboratories.

\*\*Not approved for fires of this class, but useful on surface fires where no strong air currents can dissipate vapors.

at once but, if not, the departmental fire brigade, consisting of from six to eight specially trained workers, goes into action. One squad brings up more hand fire extinguishers, another squad rolls out a large extinguisher mounted on wheels, and a third squad stands ready with a fire hose. Directed by a brigade leader, they usually get the fire out before it becomes large enough to operate the sprinklers, thus keeping down water losses.

In the meantime, a worker, charged with this particular duty, notifies the Safety Department, which is responsible for all phases of plant safety, and a squad of auxiliary police and a "Safetyman" are sent to the scene of the fire.

## TRAINED MAN ISSUES ORDERS

The Safetyman is a trained fireman, and on his arrival he appraises the situation. If required by circumstances, he calls in other departmental fire brigades as reinforcements, summons the municipal fire department and orders the evacuation of the plant. Extreme measures have never been necessary, so far, but all contingencies are provided for.

This system is highly flexible and can be adapted to industries of any size and type. Careful organization and thorough training are, of course, essential for its success. Kearney & Trecker was assisted in this work by the local fire department, and other

industries can secure this same form of cooperation. Complete information on training and equipping industrial fire brigades will be found in "A Manual for Industrial Fire Brigades," published by the National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts.

Besides being trained in fire fighting, workers should be instructed in the measures that must be taken to prevent fire. Details will vary with conditions, but the following rules are applicable to most metal-working industries.

1. Keep combustible materials, especially flammable liquids, away from all sources of heat, flame and sparks.
2. Maintain the highest order of cleanliness everywhere.
3. Keep oil-soaked waste subject to spontaneous combustion in closed metal safety containers until it can be disposed of. Remove metal chips soaked in such oils to safe locations.
4. Store and dispense flammable liquids from central locations where they will be under the supervision of persons who understand how to handle them.
5. Eliminate low flash-point liquids wherever possible.
6. Equip heat-treating furnaces with automatic safety devices.
7. Never operate cutting or welding

torches in the vicinity of unprotected combustible materials. When necessary, place a man armed with a fire extinguisher on guard while the work is being done and for 30 minutes thereafter.

- 8. Cover oil spills with a non-combustible absorbent material, approved for the purpose by the Underwriters' Laboratories.
- 9. Never smoke in prohibited areas.
- 10. Never use equipment unless its possible hazards and proper operation are fully understood.

The accompanying table lists the various types of standard approved hand fire extinguishers, which are the chief weapons in fighting small fires.

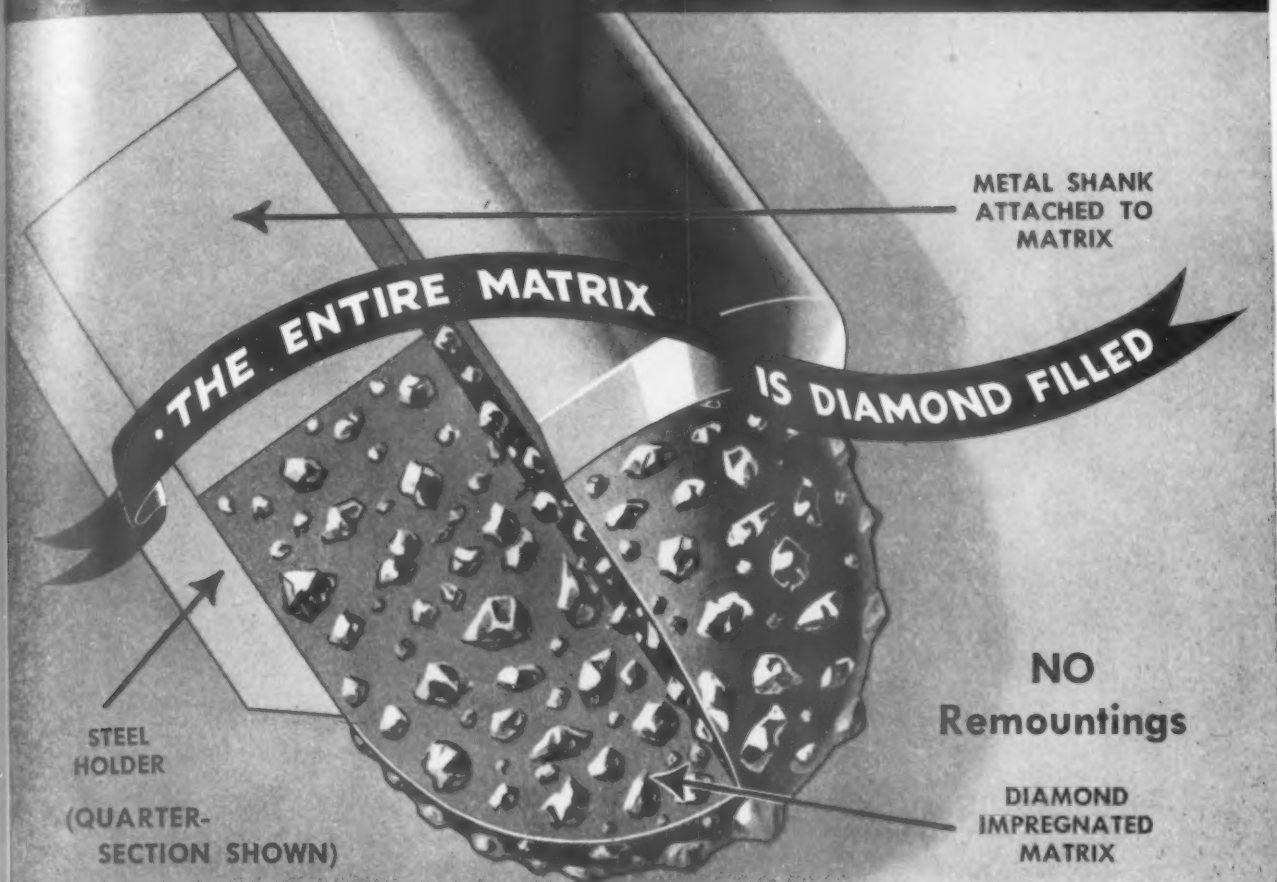
Large wheeled extinguishers, having capacities of 20 or 40 gallons, are supplied in the soda-acid, foam, and carbon dioxide types.

At present, standard approved extinguishers, which are made of enduring materials, are obtainable only by industries having high priorities. Others, however, may secure pump tank and foam extinguishers made and approved under Emergency Alternative Specifications.

These "E. A. S." extinguishers will give good service during the war emergency but, as they are made of non-critical materials, long life cannot be expected of them and they should be replaced by standard equipment as soon as possible.

THE END

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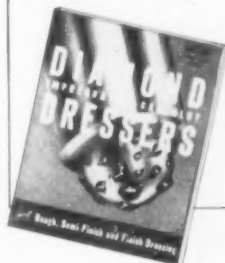
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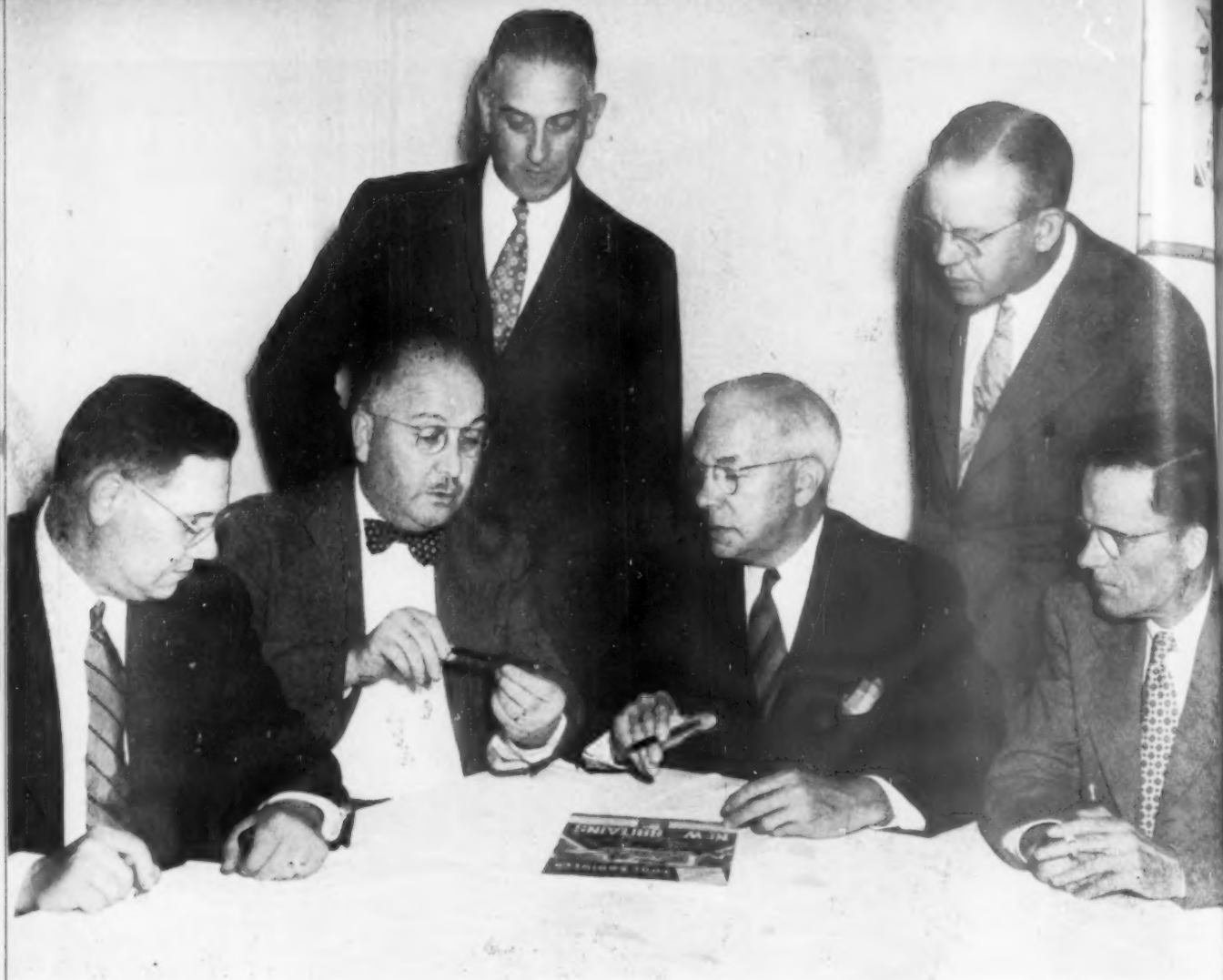


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Far-reaching changes in almost every category of mass production were visualized by these Hartford production men who attended the third in this series of PRODUCTION Round-Tables sponsored by the publisher of this magazine. From left to right: H. A. Stevens, Arthur A. Merry, C. F. Peterson (standing), Fred L. Woodcock, M. G. Dahl (standing), and R. H. James.

## NEW ENGLAND PRODUCTION ENGINEERS CONSIDER POSTWAR PROBLEMS

INDICATING unmistakable confidence that mass manufacturing in New England will rise to new high levels of peacetime productivity in the immediate postwar years, six outstanding production engineers from the Hartford area met in the Connecticut city last month for the third of a series of PRODUCTION Round-Tables conducted by The Bramson Publishing Company.

Though they are now engaged 100 per cent in war production, the Round-Table participants represented industries whose normal output requires widely divergent techniques in metal-working. Despite the assumption that higher hourly wage rates will prevail than before the war, the six men foresee in this no insurmountable barrier to tremendously increased postwar civilian goods production of better qual-

ity at pre-war or lower prices.

In answering a series of technical questions, posed by the Editor of this publication, these production men visualize the solution to these problems in higher labor skills, better utilization of tools and improvements in machines and metal-working plant layout.

As at previous Round-Tables, conducted by the Editors in Toledo, Ohio, and Los Angeles, California, opinions expressed by the Hartford conferees in no way reflect the policy of the companies they represent. Their answers to the questions posed at the meeting and other opinions they expressed are exclusively their own, based on personal experience and observation gained in the direction of mass production metal fabrication.

Present at a dinner, and participants later in the Round-Table, were Arthur

A. Merry, Chief Tool Engineer, Pratt & Whitney Aircraft Company; Magnus G. Dahl, Assistant Chief Engineer, Arrow, Hart & Hegeman Electric Company; Frederick L. Woodcock, Chief Tool Engineer, Hamilton Standard Propeller; R. H. James, Assistant Factory Manager, Veeder-Root, Incorporated; Harry A. Stevens, General Works Manager, Colt Patent Fire Arms Manufacturing Company; and C. F. Peterson, General Foreman, Tool Room, Royal Typewriter Company.

Drawing upon backgrounds of many years experience in widely varied types of manufacture, the group represents the divergent production operations required in the manufacture of aircraft engines and propellers, fire arms, typewriters, precision recording instruments and electrical equipment.

In an effort to clarify current trends

# PRODUCTION ROUND-TABLE

# PRODUCTION ROUND-TABLE

of opinion on a number of subjects vital to the metal-working industry, the Editors polled the Hartford gathering on seven specific questions. The "yes" and "no" answers received at the meeting were added to those indicated in other recent samplings of metal-working opinion. Answers to these and other questions, as received by the Editors, will be reported monthly in The Bramson Publishing Company's Poll of the Metal-Working Industry.

Though opinion was divided at the Hartford meeting on whether substantial advancements would be made in parts tolerances on such products as aircraft engines, half of the engineers present inclined toward the belief that greater precision would be utilized in many peacetime consumer products. Such standards, which have witnessed their greatest advancement in war production, should improve product quality and wearability. They will be obtained, it was believed, without additional production cost and might even be used at less proportionate cost than were the lower pre-war standards.

## RE-LOCATION OF CONTROLS DESIRED

Machine tool builders and the Government, both vitally interested in the excess machine tool disposal problem, could find encouragement in the reaction to a query regarding possible use of war-built machines. Hartford production men see an assured market for such machines in any plant where they can outproduce old equipment. Yet, if postwar designs will produce parts at less cost, they will be ordered first.

As at previous PRODUCTION Round-Tables, the demand was unanimous for changes in machines to fully utilize the recent improvements made in cutting tools. Inability of machines to maintain required tolerance at the cutting speeds possible with new cutting materials was a major complaint.

Citing numerous examples of backbending, reaching and awkward movement around machines by workers reaching for push-buttons and levers, it was agreed by every participant that many re-locations in machinery controls are needed to provide greater motion economy. The shorter the time required for the operator to reach the controls, it was pointed out, the less time is consumed in completing each machining operation. Substantial losses in production due to worker fatigue from difficult reaching for controls was emphasized.

## ELECTRONIC CONTROLS DISCUSSED

At all three Round-Tables held to date, the only dissent indicated to the application of electronic controls on machine tools has come from engineers whose operations apparently cannot be aided by such devices, or who fear the maintenance problems they visualize.

Noteworthy constructive opinion on metal-working problems was advanced by the eastern engineers in answering five other questions posed by the Editors for general discussion at the PRODUCTION Round-Table.

These questions, and the consensus of answers offered by the six participants at the meeting follow:

## ●1. What effect will labor rates have on the selection of equipment in your plants after the war?

None of the Hartford conferees foresee higher postwar labor rates as an insurmountable deterrent to a substantially higher level of civilian goods output at the same or lower prices than before Pearl Harbor. Each indicated a belief that the solution lies in better selection of machine tools for the job, and better utilization of high production equipment. More pieces per hour per machine, rather than lower wage rates, they believe, will assure prosperity in the metal-working industry after the war.

## "THE COST PER PIECE"

Merry, of Pratt & Whitney, said that though higher wage rates may obtain after the war than before, we can still produce cheaper provided we supplement labor's efforts with high production machines so that we can cut the cost per piece. "It isn't important how much you pay labor per hour," he said, "but what the cost is per piece."

"American industry must be brought to realize that the problem we face is not getting cost per hour down, but

tors limiting full utilization of the potential capacity of machines and cutting tools. Machine tool builders, production engineers and industrial architects must concentrate on this one problem, they agreed, if substantial advancements in high-speed machining are to be realized.

## NEW METHODS FOR CHIP REMOVAL

James, of Veeder-Root, said his experience with constantly accelerating feeds and speeds has convinced him that ultimate solution of this problem largely lies in the hands of the industrial architect. "Conveyers and means for ejecting chips must be provided in the design of the plant," he said, "in order to get the scrap away from the machines as fast as it is produced."

In Merry's opinion, much of the solution to this problem lies on the design board in the machine tool plant.

"The designers of the machines we are using," he said, "must devote more attention to the rapid accumulation of chips which results in the new high-speed machining operations."

"Removal of chips from the machine is now a major problem, and methods must be devised for depositing chips in

**What are New England production engineers thinking about today's machines in relation to tomorrow's problems in metal-working? In this Round-Table, six production executives offer answers**



the productivity per hour up," Merry explained. "You don't get cheapest production by hiring cheapest labor. The highest wage sometimes produces a better product cheaper."

Peterson, of Royal Typewriter, said he believes that maintenance of high level productivity, high wages and low sales prices is largely dependent upon the production engineer. "We must strive to get more efficiency out of every machine tool," he said, "in order to reduce the cost of each job."

## MORE HORSEPOWER PER MACHINE

"A marked result of higher labor costs will be greater horsepower back of each man in the shop," according to Woodcock, of Hamilton Standard Propeller. Inevitably, he suggested, instead of utilizing 10 horsepower per machine tool, we will witness the consumption of 25, 50 or more horsepower per machine tool. The tendency in machine design and machine selection after the war, he believes, will be toward production of more pieces per hour to compensate for higher wages.

## ●2. What suggestions in machine design do you have for improving chip disposal on high speed operations?

No single question posed by the Editors at the three Round-Tables held thus far has produced such spontaneous and spirited discussion. Every production engineer present at the New England meeting declared inadequate chip disposal is one of the outstanding fac-

easily accessible disposal areas through the utilization of mechanical chip handlers which will completely eliminate the human element," Merry added.

Machine tool builders have not devoted sufficient thought to this problem in their basic designs, the Pratt & Whitney Aircraft Company engineer believes. "We've had to redesign many of our newest machines to handle the chips," he said.

Peterson said he believes that today's tools are cutting so fast that vast improvements in chip disposal must be made over present methods if "we are to derive the full benefit of high-speed machining."

## HOW TO BOOST PRODUCTION

This assertion brought forth the most startling opinion advanced at the meeting. The Hartford conferees stated individually that adequate chip disposal can increase machining productivity anywhere from 25 to 75 or more per cent.

After chips have been removed from machines, probably by mechanical ejectors, Woodcock reasoned, complete solution of the problem may lie in the installation of special handling systems throughout the plant.

"One big machine shop in the automobile industry," he explained, "has a complete sewer system for coolants. All coolants and moisture on the floors are drained away to a central system where the coolants are filtered out and

sterilized, ready for re-circulating to the machines." Something of the same sort, he believes, should be applied to the chip disposal problem.

### ●3. What ideas have you for standardization of machine tool parts to simplify maintenance?

Stevens, of Colt Patent Fire Arms, described machine tool maintenance as one of the worst headaches. Lack of standardization in small parts, he said, is the chief cause of trouble.

"There is no standard for screws, bolts or nuts on machine tools," he explained. "The problem of stocking them seems to be getting worse."

#### MAKE PARTS INTERCHANGEABLE

Dahl, of Arrow, Hart & Hegeman, asked for standardization of tapers. "Why shouldn't machine tool builders standardize on tapers?" he asked. "Such a move would save us much time and expense."

In answering this question, Woodcock said that "unit design with interchangeable parts for single purpose machines regardless of the make would do as much as anything I can think of to simplify the production man's work."

"Drill heads," he continued, "is an outstanding example. One of the most important contributions that machine tool builders could make would be to standardize the pitch on change gears."

### ●4. When machine tool builders resume the use of pre-war finishes, do you want machines painted in two colors with work areas light-hued for safety?

General agreement was spontaneous in answering this question, with numerous examples of personal experience cited. The participants stressed the need for more scientific consideration of color as well as lighting. Lighting, it was suggested, is one problem totally overlooked by some machine tool builders.

#### COLOR AND LIGHTING RECOMMENDATIONS

James said his concern intends to try light colors on machines in its shops, starting on a single battery of machines to study the effects on production.

"This subject has been given scientific consideration and it has been proved that the use of shop lighting and color on machine tools dovetails," Woodcock said.

"Psychologists," he continued, "have proved that colors have an effect on the fatigue of workers. Scientific attention should be given to the study of productivity and safety through the use of various colors on machine tools."

"I would recommend," he asserted, "that anything except black and slate be used on postwar machine tools."

Dahl believes that all surfaces of a machine that the worker faces should be painted a lighter color.

"Lighting goes hand in hand with the use of colors on machine tools," according to Merry. "The subject of lighting apparently has been disregarded by many machine tool builders," he continued, "making it necessary for the user to hang a light where he can find a place on the machine."

"Up to now, this has been the best he could do," Merry said, "but it still is

## The Bramson Publishing Company's PRODUCTION POLL of the Metal-Working Industry

● Staff editors of this publication believe the answers to these questions may guide readers toward an enlightened outlook on postwar mass production. Answers gathered from the field, from the more than 20,000 readers of this magazine and at its PRODUCTION Round Tables each month, will undoubtedly reflect the thinking of the metal-working industry in the U. S. and Canada.

QUESTION	Per Cent Replying	
	YES	NO
1. Do you envision greater precision in postwar manufacturing?	50%	50%
2. Where advisable, will you replace pre-war equipment with war-built or D P C equipment?	70%	30%
3. Are changes in machine tools indicated to fully utilize improvements in cutting tools?	100%	—
4. As a general rule, should machinery controls be changed so as to provide greater motion economy on the part of operators?	100%	—
5. Do you favor electronic controls?	93%	7%
6. Are lubrication systems on machine tools today efficient, adequate and accessible?	3%	97%
7. Do you see a trend toward a reduction in stock removal for finish, by such means as precision forming, casting, forging, stretching etc.?	94%	6%

totally inadequate. The use of color and light should be combined to get the greatest footcandles, not out in the shop, but at the tool point."

Lighting, he said, should not be a problem left to the user to solve but should be engineered into the machine by the builder.

Stevens believes that the study of color on machine tools is very important and has much to do with safety for the operator. "Many accidents," he said, "occur because of poor lighting. Such features should be engineered by the builder and built into machines."

Peterson said that "all work areas and danger zones in machine tools should be painted in light colors."

"We've painted the inside of many of our machines white," he explained, "and this practice has had a startling effect not only upon the operator but also upon our maintenance men. As a result, they find it easier to work inside a machine and are more inclined to clean it up after repairs."

#### MACHINE TOOL REPLACEMENT POLICY

### ●5. How do you determine when it is economical to purchase new machine tools?

The answers offered to this question in Hartford pointed to a changing attitude in industry regarding the replacement of production machinery. No longer does the general rule prevail in regard to machine replacement, calling for the purchase of new equipment only after old machines have reached the condition where further repair or rebuilding is impossible.

Participants in the most recent

PRODUCTION Round-Table pointed to new thinking on this subject by New England industrial management. The replacement rule that says "a new machine will be purchased whenever it will produce a part cheaper and pay for itself in a reasonable period" will be the prevailing policy thereafter the war, they believe. This would be a reversal of practice in a section of the nation that once lost its leadership in mass manufacturing due to its inability to meet production costs in other parts of the country.

#### MACHINE COST VERSUS SAVINGS

Stevens said that two important factors that affect replacement policy on machine tools are complete disrepair of a unit and the ability of a new machine to produce sufficiently more pieces per hour to save its cost in not more than three years.

"Obviously," Dahl said, "all machine tools must be replaced that are beyond repair, and, even if they are still useable, they should be replaced when a newer unit will pay for itself in a short time."

The savings that paid for the machine, he explained, will be profit after its cost has been amortized.

"Replacement resolves itself into a unit problem," Woodcock said, "with every machine and every operation presenting a different problem."

"But, as soon as a new machine tool is available that will pay for itself in a short time—not more than several years—it should be purchased. That is only good business," he continued.

(Concluded on page 134)





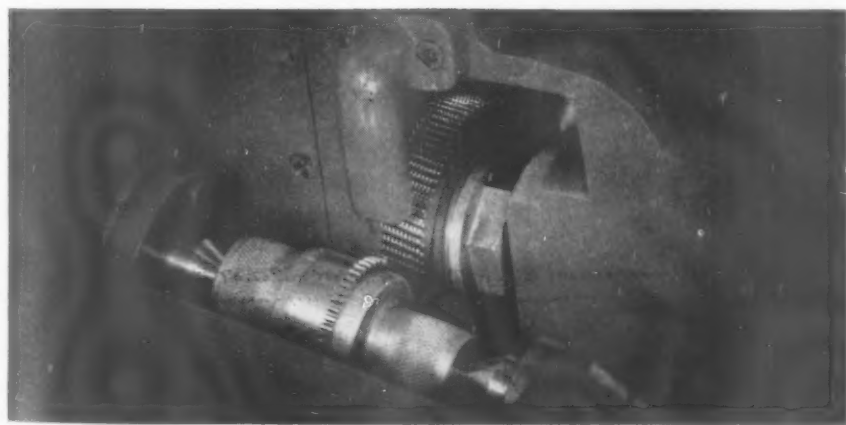
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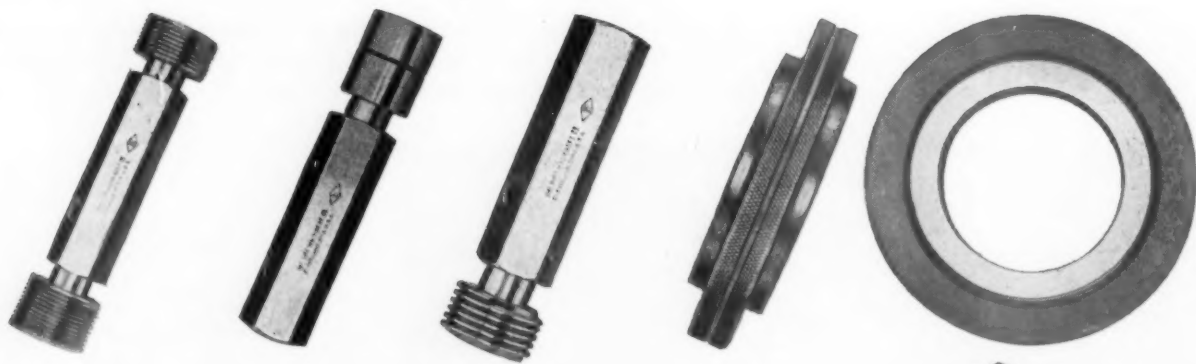
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# MACHINE TOOLS

... news and trends in the  
Machine Tool Industry ...

## Industry Squeezed by Boomlet; Skilled Manpower Needed

Squeezed between manpower shortages and tough subcontracting war production jobs, the machine tool industry struggled through April, watched shipments again fall off.

But shop men had their eyes on the front office where things were happening. Long before the end of the month industry leaders knew big news was in the offing. Orders were piling in at a pace not witnessed in months.

Early in May the Tools Division of the War Production Board made a formal announcement of news the industry already had learned through its National Machine Tool Builders Association: Orders had jumped 33.9 per cent over those placed in March.

Not only had new orders jumped during April, WPB figures indicated, but they exceeded monthly shipments of machine tools for the first time since August, 1942.

Reflecting the critical production capacity situation existing throughout the industry, actual shipments of machine tools dropped 18.6 per cent below those of March, WPB statistics showed. April shipments were valued at \$42,149,000, while March shipments totaled \$51,780,000.

Though new orders shot upward in April, cancellations likewise increased. Nonetheless, the difference still bumped the unfilled backlog fully 8.8 per cent. Orders received totaled \$56,591,000, a 33.9 per cent increase over March orders valued at \$42,264,000. Cancellations in April were \$2,351,000, an increase of 46.3 per cent over the preceding month. Thus, the industry was handed new business to the tune of \$54,240,000 in April.

At the end of the month, the backlog of unfilled orders for machine tools had jumped to \$166,867,000, an increase of almost nine per cent over the total of \$153,370,000 at the end of March.

After months of continuous decline, machine tool orders started upward in February. Since then, the increase has been steady. Gross orders in February were 18.2 per cent over January, and in March they jumped another 20.3 per cent.

What are the causes and how far will this boomlet in machine tools go? Late last year, government policy recognized the fact that the tooling of industry for war production had reached its climax, that better utilization of existing machine tools and productive facilities should permit substantial cutbacks in machine tool building.

At that time, the machine tool industry formally advised against this policy,

pointed to many instances where new machines would produce better war goods cheaper. Government policy prevailed, and machine tool builders looked for war production prime or subcontracts.

Then, early this year, revised war product requirements necessitated the output of many new machine tools. Heavy trucks and new aircraft engines, along with Russian requirements, were major contributory factors.

Now, the government is demanding machine tools—and in a hurry. The

industry, virtually caught in a wringer, says it can deliver, but not in a hurry. Builders have suffered heavy manpower losses; their shops now are jammed with other war jobs.

Things came to a head recently, when the industry Advisory Committee met in Washington with the WPB. Builders said bluntly that they must have manpower, that the ability of their industry to meet the requirements of the revised, expanded program largely depends upon the retention of present employees and the addition of many more equally skilled.

What has the industry been asked to accomplish this year? Latest official estimates of total machine tool requirements for 1944, including the backlog of unfilled orders, exceeds \$600,000,000. This surpasses the industry's annual output for any year up to 1941. Washington estimates of what the industry may actually ship this year are only around \$485,000,000.

THE END

What is the post-war outlook for the machine tool industry? For the interest of TOOL ENGINEER readers, who are buyers and users of machine tools, leaders in the industry have been invited to present their views of this vital question

## MACHINE TOOL BUILDERS ARE NOT DOOMED



R. F. ONSRUD

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R. F. ONSRUD

*"Not only redesign . . . but adopt the metric system throughout."*

● After a miraculous job of tooling U. S. Industry in preparation for the greatest showdown war this country ever got into, the machine tool industry now stands to be annihilated by virtue of its own products. Twenty years of normal work done in a little over two years now threatens as an avalanche of vengeance to drive out of business many, perhaps the majority of concerns.

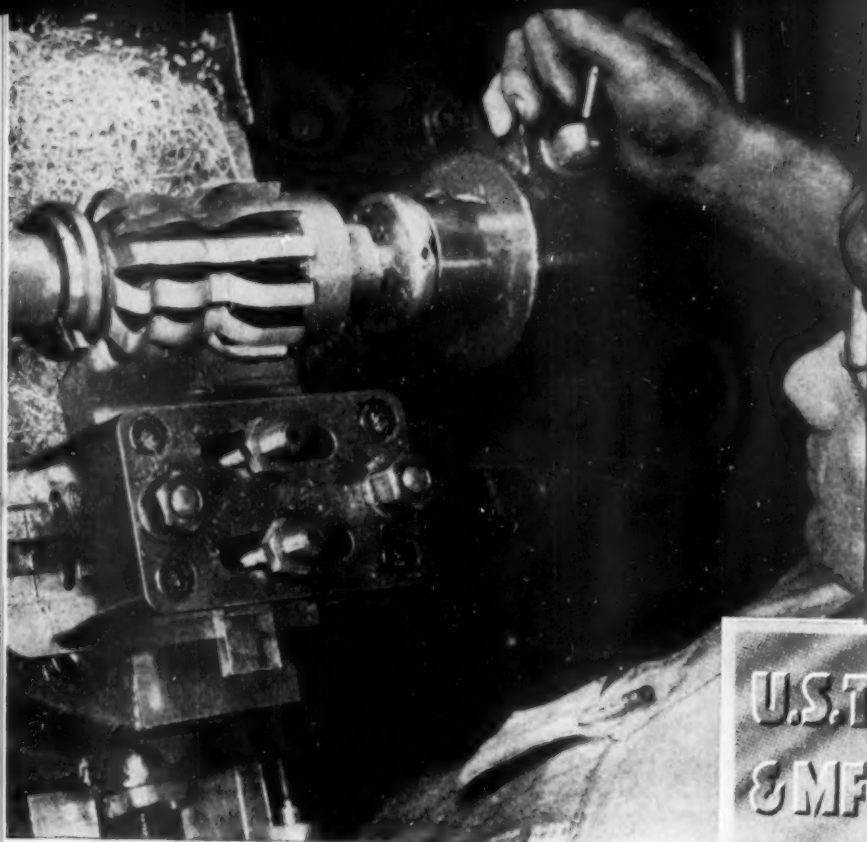
The tempo of present day living with its ever present and future problems causes people to quickly forget our unpreparedness and the scare of Pearl Harbor; and not knowing, they might even discriminate against the brains and brawn that not only staved off defeat but saved thousands of lives by not sending our troops in barehanded.

Machine tool designers down through the mechanical age have blazed a trail in establishing basics for all machinery, thereby setting the standards for our mechanized civilization. Machine tool designers are again faced with a challenge to not only save their industry but to preserve and perpetuate a continuance and improvement in our living standards.

The answer is redesign to render the immediate past obsolete. Not only redesign to make machines more efficient, or fit them for new materials, or make them highly specialized for mass production, but adopt the metric system throughout. Throw out the English system in its entirety. It will not only eventually simplify the entire mechanical industry but will tend to improve the standards of living throughout the country.

Who would want anything but the metric system in our currency medium of exchange? Who would want the tens of thousands of characters of hieroglyphics of the Japanese alphabet? A great deal could be said in favor of the metric system. Now is the time to adopt it and leave something for posterity besides war debts.

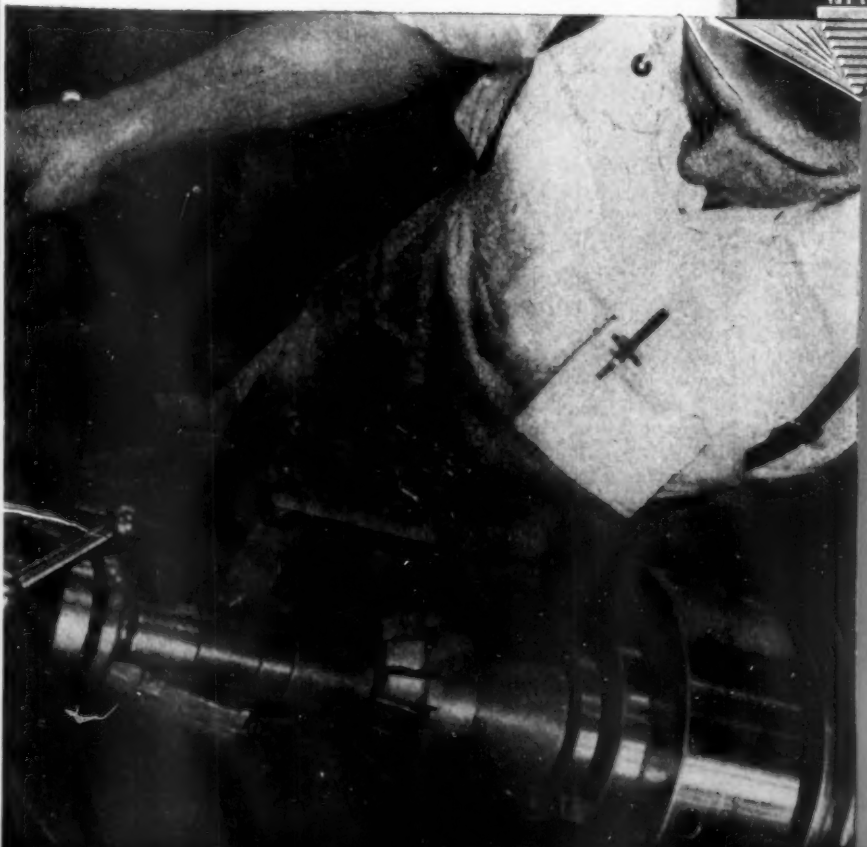




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# CAPITAL COMMUNIQUE

T. M. REG. BY THE BRAMSON PUBLISHING COMPANY

T. N. SANDIFER

Special dispatch from THE TOOL ENGINEER'S Correspondent in the nation's capital.

## WASHINGTON

THE survey by the automobile industry of its resources and requirements incident to eventual reconversion, which was launched some weeks ago following the meeting of the Industry Advisory Committee with War Production Board officials, probably will be assuming shape about the first part of July, according to all indications.

This survey, it will be remembered, was to determine the situation of the various companies as to status of present production, equipment needed, and the minimum number of cars they would have to make in order to reconvert, when the time comes, on a commercial basis.

### OFFICIALS AWAIT SAFER POSITION

Also involved was the question of space, storage for present inventories and surplus equipment, some phases of which were reviewed here in a recent issue. It is still a guess, but there is some expectation here that before the political campaign has gone very far, a great deal will be heard, of a more definite nature, as to actual reconversion plans, if not reconversion itself.

On that last point, it is currently recognized, there are too many day-to-day factors in the war situation for any hard-and-fast plans. The war will have to be within very definite calculating ranges, as to requirements, before any responsible officials will feel safe in releasing substantial production capacity for peace, obviously.

### ATTEMPT TO IMPRESS CONGRESS

No people realize better than the automobile industry leaders some of the tremendous problems involved in this whole matter, and in addition to the discussions heard here last month, with WPB, members of the industry have taken pains to see that Congress also gets the picture.

Some members of the industry in fact, have a moving picture, which many readers may have seen. In any event, it has been seen here by some Congressmen, who have been admittedly impressed. This picture shows the tremendous surplus of materials, including machines, and figures are available as to the proportion of the latter which are government-owned and which privately.

The picture points up the fear which has been expressed by these men, both before members of Congress, and in WPB meetings and elsewhere, that there will be a terrific delay and confusion at the war's end unless preparation is made immediately to move these stocks and machines.

Going from peace production to war, these men recall, was an easier matter. They were handling their own stuff

then, when they moved stocks, machines, and anything else in the way, out into back lots, or wherever it could be put. With the government material, it is pointed out, they wouldn't like to touch it until somebody responsible has approved the count, or decides how far along the manufacturing process is on a particular item.

It may be undue deference to government book-keeping, but this book-keeping enters into the close-out of all deals, and the manufacturers want everything to be in shape.

One of the first acts of the Surplus Property Administrator recently was to form a Space Control Committee, to handle the storage problem, and to assure adequate storage and safeguarding of government property, pending its disposal to private interests.

### BATT MAKES STATEMENT

The question of surplus disposal is still one of the outstanding problems of the industry as well as those agencies here dealing with it. Vice Chairman William L. Batt, in charge of the International Supply operations of War Production Board, recently stated that so far as his activities are involved there have been no programs received by the United States for machine tools for the long-range reconstruction period.

This obviously referred to suggestions heard from time to time that any disposable tools be sent abroad. Currently however, the policy appears to be that goods are sent in the order of their importance, as decided by the country involved, and the Foreign Economic Administration, through which such shipments are now routed. Shipping capacity enters the situation.

### LOOKING AHEAD WITH CAUTION

As Mr. Batt explained,

"The amount of goods which reach Russia, for illustration, is limited almost entirely by our capacity to move through the available ports into Russia; while they would like to have some of these surplus tools which we have available in the United States, we are not able to get those tools to them because of the inability to move them into Russia without sacrificing something more critical.

"The Russian section of FEA controls the total tonnage that can be made available for Russia. The Russian representatives have the opportunity of expressing their preference as to the priority of the things that go into that tonnage, and if they want more or less of machine tools, as against food, ammunition, or what, they are permitted to make that choice.

"They have had considerable quantities of machine tools, but not nearly as much as we should be able to supply

them if shipping were available."

Like others responsible in Washington for major war policy, Mr. Batt has warned that under today's conditions, the surplus of yesterday may be the shortage of tomorrow, as when it was thought at one time that the first quarter of this year would see the end of a tight situation in certain metals, only to have the turns in the war upset their calculations.

"So," says Mr. Batt, "you have to be cautious in concluding that a thing that is surplus today will similarly be in surplus six months from now. "With respect to capital construction, such as machine tools, which are an item of capital construction, I cannot conceive of any further shortage in machine tool capacity, however."

### VIEWS ON SURPLUS DISPOSAL

Some members of Congress, on both political sides, have recently showed that their membership is still concerned over the whole problem of such surplus tools, especially members from industrial sections of the country. Rep. Taber, Republican, New York, in a recent hearing of the House Appropriations sub-committee considering this, among other matters, asked Vice Chairman Batt if he didn't realize that these surplus machines, with the possibility of diverting them to use where they are not needed, may become "a postwar menace" of the worst character.

Mr. Batt said that properly handled, he didn't think raw materials themselves constitute a threat, but that he would agree fully with the view that if we could find uses today for such machine tools, it is certainly desirable to do so.

Another aspect of the discussion comes from Rep. Rabaut, Democrat, of Michigan, who naturally has a close interest in the matter.

"I think we have to put machine tools in certain categories," he remarked. "When we entered the war we had certain machines and lathes. We had lathes that were 40 years old, and we were very glad to get them, and glad to use them. However, they cannot compete at all with the lathe that has been built recently. They are not nearly as precise. They are not ball-bearing. They have not all of the modern attachments to them; they haven't a revolving head—just old-fashioned lathes, still we were glad to use them.

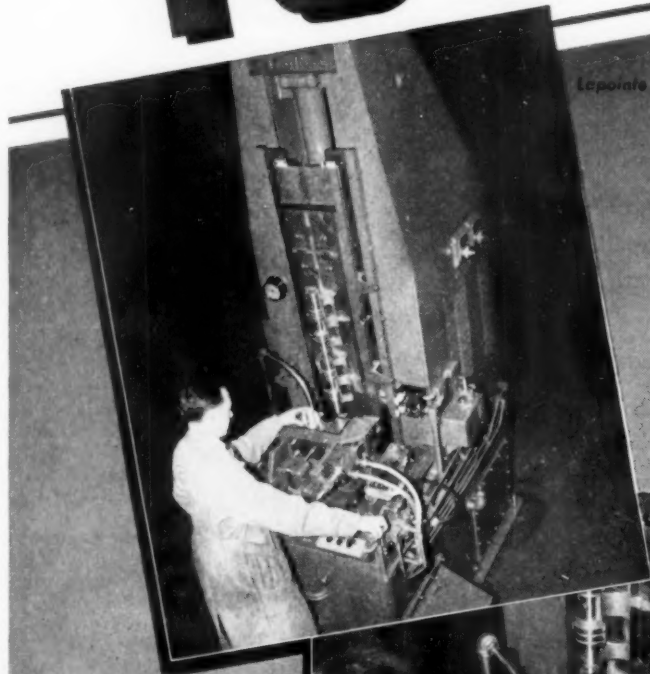
### JUNK OR USE OLDER TOOLS?

"In the minds of engineers and operators, they think with this great production of modern machine tools that certain of these older tools are going to have to be junked, and some others put in certain categories of usefulness. That with new production for peacetime pursuits we want to go into it using our latest machinery."

On the other hand, Rep. Taber believes there are many factories in the country right now, as he says, that use machine tools, and that would like some of the surplus equipment, which they could use to good advantage in production if they had it. For this reason, he advocates that such surplus tools be allocated now, instead of waiting.

On a later occasion Rep. Buell Snyder (Concluded on page 113)

# 400 *an hour!*



Lapointe Vertical 5-ton.

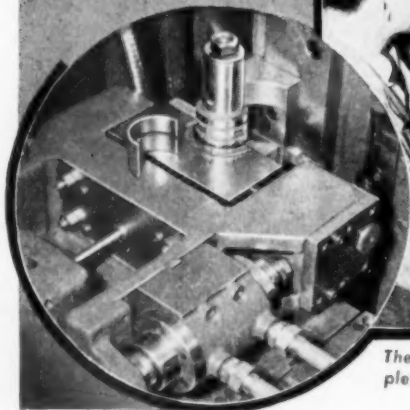
Producing close tolerance finishes on the inside of engine bearing linings at anywhere near mass production figures was considered an impossibility until broaching was called in. Now, 400 bearings an hour can be made—reducing “breaking-in” periods and eliminating hot spot replacements.

Because of the unevenness of bearing linings broaching engineers figured a maximum and minimum cutting action and devised cutting blades to cover maximum babbitt removal. Cutting at 60 feet per minute with a 120 foot return this vertical, 5-ton, 32” stroke Lapointe Surface Broaching Machine produces a finished

wall thickness to .0001 tolerance and is one of the fastest cycle time machines on the market. It has a special automatic fixture that makes loading and unloading easy. Each of the cutting blades removes a maximum of .010 each stroke, when maximum stock is to be removed, and are so arranged that regardless of thickness of babbitt the bearing comes out completely finished well within tolerance. It operates thus:

1. Work is put in place starting cycle.
2. Fixture moves into cutting position.
3. Machine slide completes cutting stroke.
4. Fixture returns to out stop.
5. Main slide returns ready for next cycle.

Inserting work at start of cycle.



The finished work—completed stroke.

It's the machine, the broach and the unsung design engineers who made this pertinent contribution to production.

The

**LAPOINTE**

*Machine Tool Company*

HUDSON, MASSACHUSETTS, U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



## CAPITAL COMMUNIQUE—

(Concluded from page 111)

der, Pa., a Democrat, reported that he gets a good many inquiries and demands about machine tools, asking what Congress is going to do, and as he stated, expressing the fear that when the war ends, there will be so many machine tools that their manufacturers will have to close down.

"We will have a lot of them," he remarked, "and I assume a lot of them can be used on axles or spindles going into peace production, but I also would like to know what the plan is."

"The thing I am hoping," he said, "is that a lot of this machine tool equipment will not fall into the hands of some organized syndicate, when it might be used in schools, vocational training, etc. It might better go to such use than be bought up by these syndicates, such as the one that has been reported as buying up cars, for example."

Director of War Mobilization James F. Byrnes, however, recently told Mr. Synder;

### AMERICA'S POSTWAR COMPETITION

"One thing I have in mind when you speak of machine tools," he said, during a committee hearing, "they are going to play a considerable part in our progress hereafter. A plant with modern machinery and modern tools can undersell a plant with old machinery. We found that out long ago in the textile field."

So, said Mr. Byrnes, "we now are going to have the advantage of having the best machinery and the best machine tools ought to give us an advantage over those who don't have them."

With further reference to possible sales abroad, there are some in Congress and out, who do not view the matter as an unmixed benefit. There is some criticism, among isolationist elements of the Senate, it is true, of the fact that among Lend-Lease goods sent to Russia for example, has been some \$400,000,000 worth of industrial equipment.

How much, these critics ask, represents machinery that will be used to compete with America when the war is won? Or, the same critics ask, how much will not be used, or even uncrated until the war is over?

The latest Lend-Lease figures show that actually half the goods in this category sent to Russia, or approximately \$200,000,000 up to March, represents machine tools.

### WHERE LEND LEASE TOOLS WENT

Machine tools form an important part of such goods shipped to Australia. From March, 1941 to December, 1943, an analysis by the Foreign Economic Administration shows that Russia got 48.8 percent of machine tools shipped by us under Lend-Lease, United Kingdom 40.6 percent, Australia, 5.9, India 2.6 percent, and other countries, 2.1 percent.

Significant is the fact that between \$400 and \$600 million represent machine tools requisitioned for Lend-Lease. Of the total requisitioned, nearly \$400 million worth of machine tools were exported by December 31, 1943.

THE END

JULY, 1944

## KEEP 'EM FLYING with KENNAMETAL-TIPPED Milling Cutters

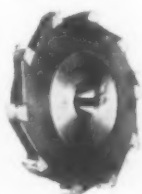


America's astounding record in airplane production will go down in history as one of the vital factors in winning World War II. Behind the scenes of this achievement are major advancements in technic of metal-cutting—among the most important of which is Kennamilling, the process of using Kennametal-tipped cutters to mill any kind of metal, including the toughest steels, at almost incredible speed.

Kennamilling has contributed tremendously to the war effort, and will have a significant bearing on post-war production. Consider, for example, the savings effected in the following three instances:

- (1) Milling  $\frac{1}{2}$ " slots 9 inches long in alloy steel parts required 75 minutes with H. S. S. cutters. Kennamilling does the job in 70 seconds!
- (2) Face milling aluminum castings with H. S. S. cutters resulted in 10 finished surfaces per hour. Kennamilling turns out 125 per hour, and the quality of the work is much improved!
- (3) A multiple-pass milling job on heat treated steel billets was done with Kennametal-tipped cutters in  $\frac{1}{12}$ th the time required with H. S. S. cutters!

Switch to Kennamilling now—speed present war work—be equipped and gain the "know-how" for economical production in a future competitive commercial market. Ask a Kennametal field engineer to tell you about the revolutionary advancement in milling practices with Kennametal-tipped cutters. Write for catalog information.



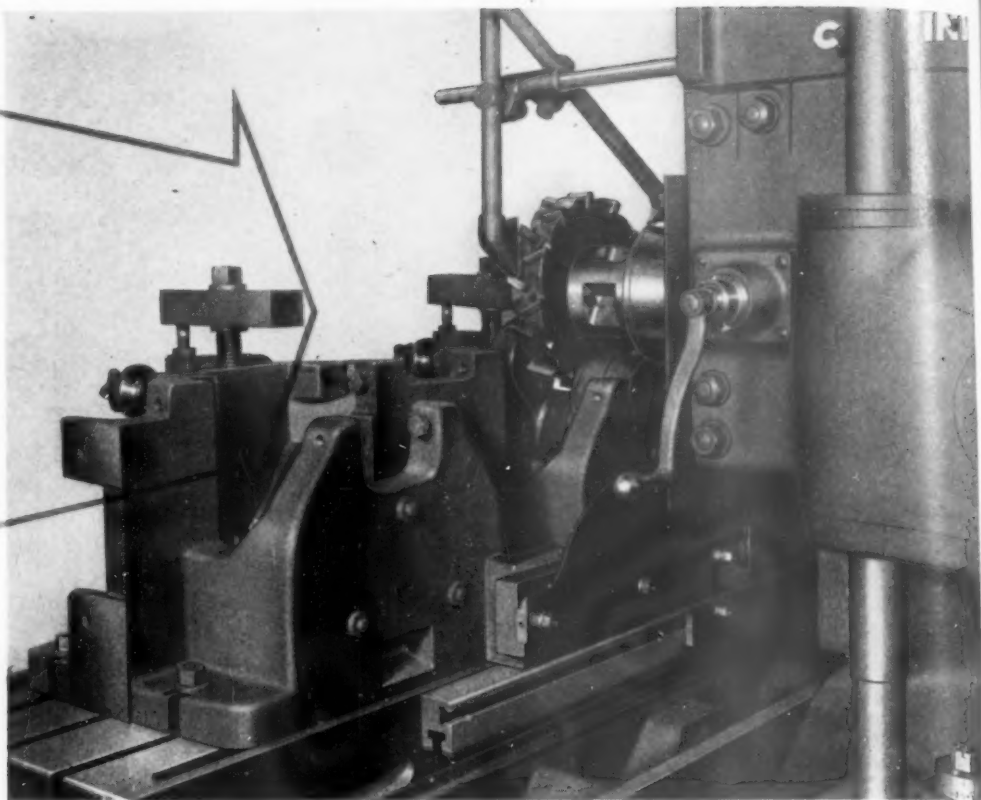
**KENNAMETAL**

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.



Illustration of part being milled is shown above. Color indicates milled surfaces. The machine (tooled up by CINCINNATI engineers) is a 5-48 Plain Tracer Controlled Hydromatic equipped with variable feed attachment; high headstock for increased vertical range; long quill and spindle for extended cross range; and inserted tooth cutter, 13" diameter by 3-1/16" wide.




## Tracer Controlled **HYDROMATICS**

*Get the corners, too!*



CINCINNATI Plain Tracer Controlled Hydromatic. Also available in Duplex Style. Catalog M-1295 contains complete specifications on both styles.



**A**LMOST any milling machine can mill straight across a surface in a horizontal or vertical plane, but it takes a particular type of machine to profile mill around a boss and get the corners that would be missed by a conventional miller. The CINCINNATI Tracer Controlled Hydromatic in the illustration above does the job *automatically*; milling the counterweight surface of aircraft engine crankshafts, while profiling around the center bearing, like this: 

The equipment, engineered by CINCINNATI includes two hand clamping fixtures. Automatic feed cycles (a feature of all Hydromatics) permit the operator to devote his entire attention to the productive job of loading and unloading the fixtures, working at one station while the other is cutting. Automatic variable feed is also included, as a necessary adjunct to tracer controlled milling.

This method of milling introduces new possibilities in economical shop practice. Our engineers will be glad to tell you about CINCINNATI Tracer Controlled Hydromatics, and to apply the tracer controlled method of milling to your present and future requirements.

**THE CINCINNATI MILLING MACHINE CO. CINCINNATI, 9 OHIO, U.S.A.**

**TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES**

# INDUSTRIAL NEWS DIGEST

... a review of significant developments and new techniques  
in mass production industries ...

## Screw Machine Capacity Listed by Products Association

CLEVELAND—Industrial trade association work was given a new twist here when the National Screw Machine Products Association announced the establishment of a clearing house for information on available machine capacity.

All member companies are now reporting, to the association, machine time presently available and capacity expected to be available in the near future. Additional information furnished by these companies enables the Association to promptly locate the manufacturers best equipped to produce a particular part.

This service is provided free to buyers of screw machine products. Names of suppliers having suitable available capacity may be obtained by furnishing the Association with a description of the required part, including type of material, tolerances, and quantity.

Inquiries should be addressed to: Department K, National Screw Machine Products Association, 13210 Shaker Square, Cleveland 20, Ohio.

## Record-setting Safety Program Revealed by American Can

NEW YORK—Encouraging news in light of the mounting war production manpower loss due to accidents is the announcement that during 1943 the Central division of the American Can Company held its accident frequency rate to 9.87 as against 19.5 for the tin can manufacturing industry.

The record was set, according to Theodore C. Meisner, director of safety for the division, in the face of an increase of 2,200,000 added hours of exposure to accident hazards. Accident frequency generally is defined as the number of lost time accidents per 1,000,000 man hours worked.

The rate for the entire company was 11.87 last year, or only slightly higher than the average of 11.39 maintained for 15 years, Mr. Meisner added. This rate was maintained, he said, despite such wartime hazards as inexperienced part-time workers, employees who were both older and younger than in normal times and employee-fatigue due to the pressure of war production work.

In the can company's Amertorp plants in Chicago and St. Louis, the accident rate was only slightly more than seven, compared to 26.2 for machine shops in general during 1943.

Since Pearl Harbor, 37,600 workers

were killed in industrial accidents according to a U. S. Department of Labor report. Currently, the nation is losing through accidents 270,000,000 industrial man days annually, which is the equivalent of taking 900,000 men from production lines for one year.

The can company's accident prevention program is based largely on impressing upon workers the necessity of being constantly alert to accident hazards and encouraging them to refrain from any carelessness which might result in an accident.

Plants are separated into zones and responsibility for each zone is delegated to a key employee. Meetings with the key men are held once or twice a week.

## Wright Establishes Aircraft Engine Production Record

PATERSON, N. J.—A milestone in the history of mass production was passed here recently when the Wright Aeronautical Corporation established an all-time record for the manufacture of aircraft engines designed by one company.

Between the entry of America into the present war and January, 1944, the  
(Continued on following page)

## HUMAN MICROMETER



Warren Black, the man with the precision touch, who has maintained a perfect inspection record for 20 years.

The story of Warren Black, 79-year old precision instrument worker, is one of age and "precision touch". The removal of all barriers to age in industrial employment no longer makes news. But "Blackie's" age is significant because of the work he is performing at the Brown Instrument Company, Philadelphia precision industrial measuring and control instrument manufacturer.

Through sight and touch alone, Mr. Black distinguishes the difference between .0020", .0022" and .0024" platinum wire diameters. The inspectors with their instruments haven't been able to catch him in a mistake during the 20 years he has devoted to such intricate work at Brown Instrument.

## "GREENIE"

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

Why Bosses Turn Gray





production of Wright Cyclone and Whirlwind aircraft engines totaled 284,200,000 horsepower, or 93 times the combined power capacity of the Bonneville, Grand Coulee and Boulder Dam hydroelectric plants.

This production includes installation engines and spares built in Wright's Paterson and Cincinnati plants, and the Cyclone 9's of 1,200 horsepower built under license by the Studebaker Corporation for use in bombers, and the Whirlwind 9's of 400 horsepower built under license by Continental Motors for medium tanks and gun carriers.

According to M. B. Gordon, vice president and general manager of Wright, the bulk of the production was on Cyclone 9's of 1,200 horsepower for such planes as the Boeing B-17, Douglas Dauntless and Lockheed Hudson and Lodestar, and on two models of the Cyclone 14, one at 1,600 horsepower, mainly for the Douglas Havic and Martin Baltimore, and the other at 1,700 horsepower for the North American Mitchell, Gramman Avenger, Curtiss Helldiver and Martin Mariner and similar combat aircraft.

However, during 1943 the volume of horsepower was swelled as the Cyclone 18 of 2,200 horsepower was placed in quantity production. In addition to combat planes, this big Cyclone is also

(Continued from preceding page)

being built for The Lockheed C-69 and the production versions of the Martin Mars.

In two years, the company had to design, construct, and tool new plants, representing a 150 per cent increase in manufacturing area, although the manufacturing area had already been increased more than five times between the outbreak of the war in Europe in 1939 and Pearl Harbor.

Finding more than 40,000 additional employees to man these plants called for the use of women in many productive capacities. In the last two years the percentage of women in the shop has increased from 6 per cent to approximately 35 per cent.

One of the greatest changes in production during this period of expansion has been the trend from standard machine tools formerly used to high production types. Small production volume of past years did not justify use of these types but their work under present conditions has been clearly demonstrated, not only in the rapid acceleration of output described above but in decreased man hours and dollars required per horsepower produced, according to Wright engineers.

Much effort has been expended in developing new techniques for using

these machine tools at maximum efficiency, and it is estimated that resulting annual savings have amounted to \$10,000,000 in materials, and 644,600 man hours.

Manpower utilization has received intensive study by Wright, and has played an important part in increasing horsepower produced per man per month from 82 to 109.

### Nelson Pleads Against Strikes; Fails to Answer Automen

DETROIT—Late in the spring, Charles E. Wilson, Executive Vice Chairman of the WPB, slapped labor's hands, charged union leaders and union members with slowing war production by striking for "petty" reasons.

Wilson made his charges in a mid-western speech, far from politically conscious Washington. His warning's fell on deaf ears, for serious strikes continued.

Then, at the close of a month that witnessed the greatest loss in man-hours due to wartime strikes in the motor capital's history, Donald Nelson, WPB Chairman, arrived in Detroit on the day before the European invasion to blast both labor and management for failure to find common ground for understanding.

The serious, conscientious WPB boss, still rumored to be interested in national politics, took a politically smart middle course by explaining that there might be far fewer strikes in the "arsenal of America" if management would not goad the unions. Nelson's efforts failed for one good reason.

Labor relations in Detroit industry are an open book. Labor editors on the big newspapers here have free access to all of the plants and the "inside story" of every big strike is front page news. Nelson could not prove his assertions and Detroit knew it.

In an interview before returning to Washington on "D-Day", Nelson told The Tool Engineer magazine he saw no reason to qualify his controversial remarks made the previous day before automotive and union leaders.

"Detroit has done a magnificent job," he said, "but the greatest task of all still lies ahead. You cannot—must not—fail in your duty because of involvement in petty bickering".

Nelson's visit to Detroit, concluding a swing through mid-western war production centers, was believed to stem from an effort to counteract the downward production trend as reflected in April's loss of two per cent in overall output.

Touching on the confused situation in war production that has produced temporary layoffs and cutbacks while the overall production goal for the year is 20 per cent higher than last, Nelson said the WPB now was trying to prevent the forced migration of war workers from one center to another.

On conversion of plants from war to civilian output, the nation's production chief spoke all too briefly to satisfy.

(Continued on page 118)

## NEW INDUSTRIAL ERA WILL OBSOLETE OLD METHODS

No segment of American industry deserves more credit than cutting tool manufacturers for the victory we have achieved on the production front. Likewise, future trends in mass production metal working are contingent on wartime and postwar developments in cutting tool design and materials. Here is another in The Tool Engineer magazine series on the postwar outlook from the viewpoint of prominent cutting tool producers.



**K. R. BEARDSLEE**

VICE PRESIDENT  
CARBOLOY COMPANY, INC.

WITH his bare hands a man can dig just so much earth in a given time. Give him a spade and he multiplies his digging ability. Give him a bull-dozer and he can do in a few days what might otherwise have taken a life time to accomplish.

Marvelous as our pre-war industrial accomplishments were, we learned from the necessities of war that we had but barely scratched the surface. We are today on the threshold of a new industrial era in which the ability of man to produce for a higher standard of living will obsolete everything that went before. Electronics, plastics, carbides are neither toys nor expedients. They are the heralds of a higher standard of living which will arise from an industrial revolution which is already with us.

Just as an example, newer forms



"... on the threshold of  
a new industrial era ..."

of cutting tools already have proven their ability to double and triple the output of men and machines, lowering costs while increasing the earning power of both labor and capital. Consumer industries have yet to enjoy the full benefit of this.

And that is only the beginning. Through the advent of new and harder metals—the metallurgist, the design engineer—even the machine tool producer—has acquired a wider horizon as to his own potential contributions to a better and revitalized postwar industrial world.

# For Tool Room Bosses Who See Red

Let BLUE FLASH Tool and Cutter Wheels help lighten your load and pick up the time lags with their

1. **Cooler cutting**... Bay State's H9 vitrified bond is so tenacious that less is needed to hold the abrasive grains... a feature that helps wheels cut better... last longer.
2. **Cleaner and faster cutting**... Blue Flash wheels have special abrasives designed for various tool room grinding purposes. The most generally used is Bay State's "AAA" resulting in a pure white product. For production and duplicate parts grinding, both A6 and AA2 abrasives give outstanding performance — these products are blue in color.

Bay State makes a complete line of tool room grinding wheels for every purpose...

for cemented carbides, for tool salvage, notching, fine finishing, small surface grinding, and general cutting-off.

Where extra coolness and fast cutting is vital, Bay State's KOOLPORE wheels, with their very open porosity, are getting the call in many shops.

Bay State offers the broadest line, the most practical features; fractional grades... controlled porosity; the finest honing and finishing stones made; expert engineering assistance to help you get the most from grinding — "fit the grit to the grind".

Write for additional details and tables on Blue Flash Tool and Cutter Wheels. Ask for bulletin F.

**BAY STATE ABRASIVE PRODUCTS CO.**  
WESTBORO, MASS.



**BLUE Z FLASH GRINDING WHEELS** ***EAST and COOL***



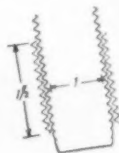
# TAPPING TIPS

From Woody Spencer's Notebook

## THREAD DEPTHS



The "longer thread, more strength" idea may have its points but most of the fellows I've talked to agree that it's best to design threaded parts so that engagement is  $1\frac{1}{2}$  times the diameter with 75% of full thread. This serves to stress the male member before the female thread. It also reduces the trouble ordinarily encountered in excessive thread depth and holds tap breakage possibilities to a minimum. When too much length of engagement is specified, some of them recommend counter-boring or relieving beyond the required amount of thread.



"Woody Spencer's Notebook" is our way of trying to pass along ideas and tips we've accumulated through the years we've been making fine taps. Tapping success, however, depends on so many variables that the suggestions we make may not work in every case. We've seen them work enough times though to make us think tapping men may find them worth while.

Almost every tapping operation presents individual problems so we cannot suggest too strongly that you send us complete details of any tapping problem (material, diameter, depth, etc., etc.) our engineers will be glad to make specific recommendations covering your specific problem.

\* Note: Woody Spencer's Tapping Tips will appear here as regularly as "Woody" gets time to write them up. Watch for them.

THE RIGHT TAP AT THE RIGHT TIME

*The Wood & Spencer Company*  
Cleveland 3, Ohio

## INDUSTRIAL NEWS DIGEST

(Continued from page 116)

fy the automobile industry. Machinery has been set up by the armed forces and the WPB to effect a smooth and orderly transition, he explained.

"We'll make mistakes," he said, "It won't all be done without a hitch. But we're going to do everything in our power to make the production of civilian goods dovetail with the decline of war production."

Automen had one question, "When can we start getting ready?" Their question went unanswered.

### Gear Manufacturers Hold 28th Annual Meeting; Elect Officers

RYE, N. Y.—Record attendance for the event was established May 22-24 when more than 200 persons gathered here for the 28th Annual Meeting of the American Gear Manufacturers Association.

New officers elected at the three day meeting, held at the Westchester Country Club, were:



Mr. Botsai



Mr. Tripp



Mr. Christensen



Mr. Schmitter

**President:** Louis R. Botsai, Manager, Gearing Division, Nuttall Works, Westinghouse Electric & Manufacturing Company.

**Vice President:** Paul W. Christensen, President and General Manager, The Cincinnati Gear Company.

**Treasurer:** Raymond B. Tripp, Vice President, The Ohio Forge & Machine Corporation.

Recipient of the Edward P. Connel Award, presented annually by the Association in recognition of distinguished service to the industry, was Walter P. Schmitter, Chief Engineer, The Falk Corporation. Schmitter (see Heavy Duty Gears, The Tool Engineer, January, 1944) is a past-president of the Association and is well known for his technical contributions to gear design and manufacture.

New Association directors named: A.  
(Continued on page 120)

THE TOOL ENGINEER



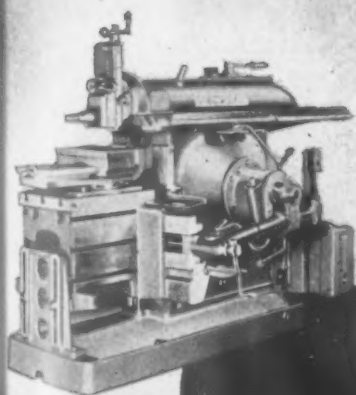
# INTERNAL SHAPING...



In the field of internal shaping alone, Cincinnati Shapers are used on a long list of "hard to get at jobs"—from cutting internal key ways to cutting symmetrical and non-symmetrical holes.

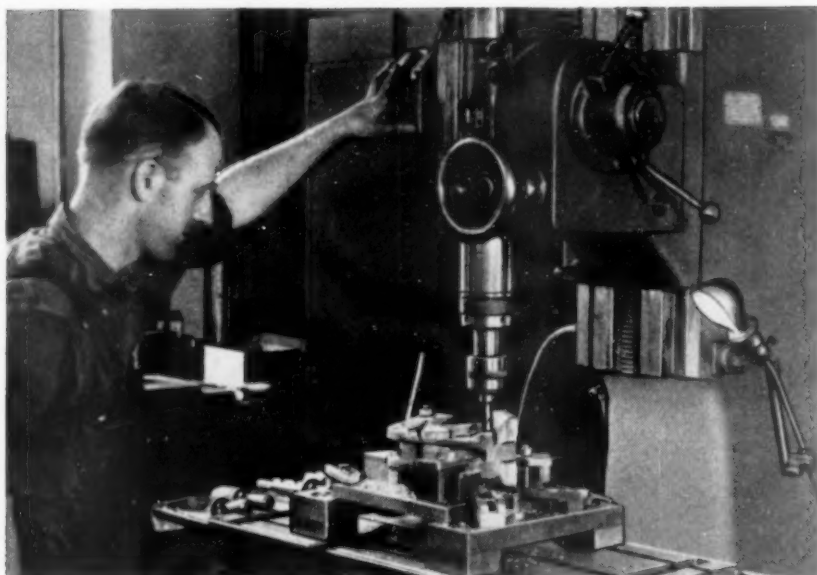
We show a Cincinnati Shaper shaping internal key ways in a blind hole—a "hard to get at job." Remember, a Cincinnati Shaper, the tool of many uses, will always be busy in your shop.

Write for Catalog N-2, describing these powerful accurate Shapers.



## THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.  
SHAPERS • SHEARS • BRAKES



## KEEP SPINDLES TURNING

On multi-operation drill-press jobs, WIZARD Quick-Change Chuck and Collet Outfits keep spindles turning. Tools can be changed without stopping or slowing the spindle. To insert a tool, the operator merely pushes the collet into the revolving chuck, and the positive automatic latch instantly locks the tool in place. To release a tool, the operator puts a slight pressure of the thumb and forefinger on the knurled collar of the chuck; the collet, released instantly, drops into the operator's hand. This means continuous action on multi-operation jobs. WIZARD Chucks hold tools rigid and centered, an exclusive McCrosky feature. And with the protection given by WIZARD Friction-Drive Tapping Collets, the operator can bottom-tap safely at drilling speed.

For full information write to McCrosky, Meadville, Pa., for Bulletin 16-D or the McCrosky Quick-Change Chuck Manual.



## INDUSTRIAL NEWS DIGEST

(Continued from page 118)

H. Candee, Gleason Works; C. R. Straub, Michigan Tool Company, J. W. Hertzler, Worm Gearing Division, DeLaval Steam Turbine Company; and W. L. Schneider, Falk Corporation.

Citing the need for the restoration of reasonable operating costs as a major postwar problem in the metal working industry, F. D. Newbury, Vice President, Westinghouse Electric and Manufacturing Company, told Association members in an address that the many manufacturing economies which industry has effected during the past decade have been more than offset by wartime extravagances.

The miracle of war production, he said, has resulted in no small measure from expenditure of tremendous sums of money. As an example of the manner in which operational costs have skyrocketed, Mr. Newbury said that while the cost of training a new worker once was reduced to \$200.00 it has now mounted to as high as \$1,200.00.

Production in the gearing industry continued to decline during April, reports from Association members showing a decline of more than 36 per cent below the preceding month.

This figure, based on sales volume, does not include turbine or propulsion gearing. The Association index figure for April was 303.

### WPB Restrictions on Gages are Relaxed; Deliveries on Order

WASHINGTON—The gage industry is over the "hump". Once one of the critical items in the war production program, gage blocks, production and inspection gages and tool room specialties are now being delivered on order.

Previously controlled by General Preference Order E-5-a, these products were placed on the unrestricted list early in June.

In an amended order, the WPB Tools Division continued control over micrometers and similar measuring instruments. A rating of AA-5 for these tools are now required at the producer level only. The new order provides that 20 to 25 per cent of monthly production be set aside for stock orders.

### Mass Production Methods Applied to Landing Barges

WARREN, O.—The pressure of war production has witnessed the application of automotive assembly line techniques to many industries. Most recent of those to benefit from the introduction of in-line manufacture is landing craft.

Joseph W. Frazer, applying experience gained as president of Willys-Overland Motors, now heads a dry-land shipyard here, which test-launches the Navy's LCM-3, mechanized landing barge, in a 34,000 gallon "indoor ocean".

Purchasing the assets of the Warren City Tank and Boiler Company, the former automotive production executive organized the Warren City Manu-

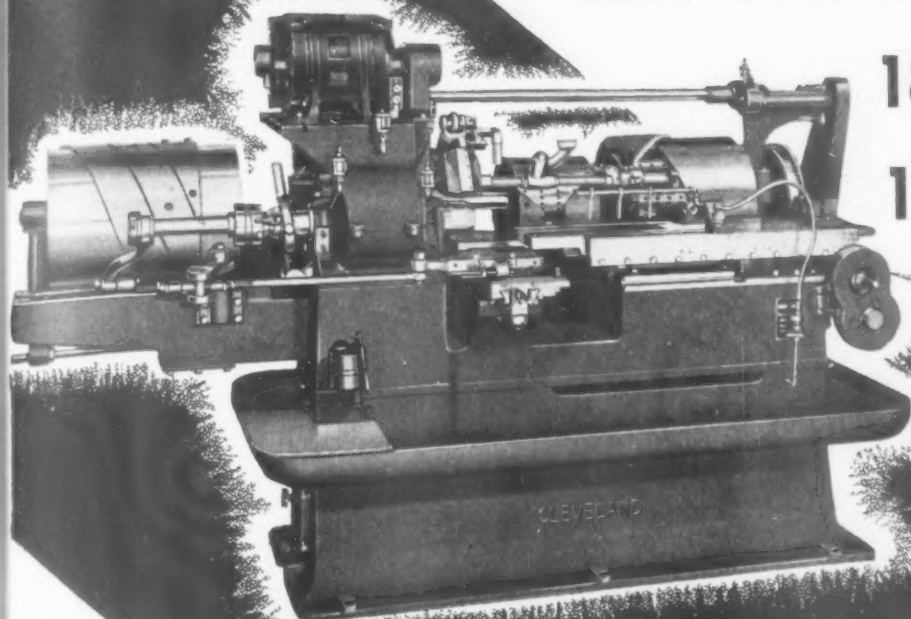
(Continued on page 122)

# There's a **CLEVELAND** for **AUTOMATIC**

Low Cost Machining on

18" Bar Stock

1½" to 2½" O.D.



Cleveland makes the only complete line of full automatic machines with bar stock capacities from 9/16" to 10" . . . Also high-pressure hydraulic die-casting machines for magnesium, aluminum, bronze, brass or zinc. Write for Cleveland bulletins on automatic or die-casting equipment.

*Remember — CLEVELANDS CUT COSTS*

**THE CLEVELAND AUTOMATIC MACHINE COMPANY**

CLEVELAND 3, OHIO

SALES OFFICES

CHICAGO (6): 1408 Civic Opera Bldg. DETROIT (2): 540 New Center Bldg. CINCINNATI (2): 1315 American Bldg.  
NEWARK (4): 902 American Insurance Bldg. HARTFORD (1): 529 Capitol National Bank Bldg.



# Avey

now represented  
by

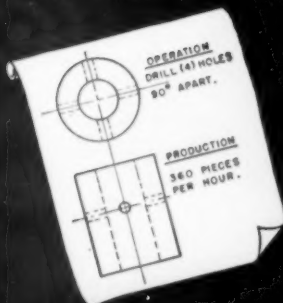
**The Motch and Merryweather Machinery Co.**

throughout

**CLEVELAND • DETROIT • CINCINNATI**



## Avey Automatic METHOD No. 2

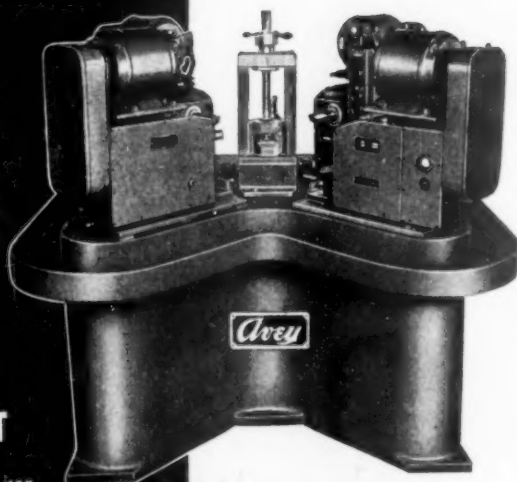


### THE Avey CAM FEED UNIT

No. 1 Size— $\frac{1}{2}$ " capacity in cast iron.

No. 2 Size— $\frac{7}{8}$ " capacity in cast iron.

**designed for multiple  
directional drilling,  
reaming, boring or  
tapping (high production)  
at one stationary  
clamping of work**



The AVEY Cam Feed Unit (Avey Automatic Method No. 2) — high production at low labor cost —  
The enabling of semi-skilled operators to deliver High Quality Production: Speedily, Accurately, Efficiently, and with a minimum of supervision.

THE AVEY DRILLING MACHINE CO.  
CINCINNATI • OHIO • U. S. A.



# Avey

**DRILLING  
MACHINES**

## INDUSTRIAL NEWS DIGEST (Continued from page 120)

facturing Company early this year. The Navy built and equipped the plant two years ago at a cost of \$9,000,000.

Utilizing the pre-assembly method of manufacture, such parts as the stern, pilot house, decks, frames and hatch covers are fabricated individually and brought to an assembly line where the all-welded craft is constructed upside down on steel, wood and concrete jigs.

The barges are rolled over for Diesel installations and are then motor-tested in a steel bath tub near the end of the assembly line.

### Few Excess Abrasive Items Visualized by Producers

WASHINGTON—Unlike the machine tool industry, producers of abrasive products and grinding wheels will face little or no sales problems as a result of excess war-produced items.

Prominent representatives of the industry, here for a WPB Abrasive Industry Advisory Committee meeting, stated that because most grinding wheels are "tailor made" for special operations, surplus stocks of abrasive products in the hands of users will not constitute a serious postwar problem.

These special-purpose end products, which have become surplus as a result of overbuying, contract changes and terminations, are not suited as general purpose abrasives and probably will have to be scrapped, committee members told government officials.

Complete loss of such materials may be prevented however, for the industry has recommended that producers be advised of inventories of abrasives they manufactured that may have been reported to WPB as surplus. With such lists, producers can then determine what items are standard products, readily resalable.

Plans for the disposal of such excess stocks are now being formulated.

### MATERIALS

#### Industry Leader Clarifies Postwar Rubber Outlook

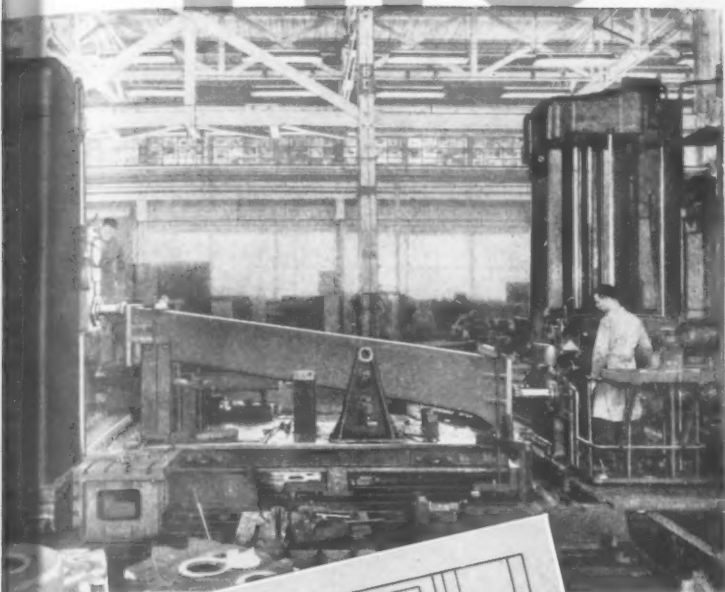
NEW YORK—Clouded by wartime censorship and conflicting statements of governmental and private opinion, fewer concrete facts are known generally about the future of rubber than of any other basic manufacturing material.

Separating the chaff from the wheat—winnowing out irrefutable and simple facts from the maze of technical data and statistics—one of the nation's most rubberwise engineers recently presented a clear and concise picture of the rubber industry today and tomorrow.

Thanks to synthetic rubber, "the future of the rubber industry appears as bright as any that can be mentioned, and far above the average," Dr. R. P. Dinsmore, Vice President of Goodyear Tire & Rubber, recently told a gathering of the National Association of Purchasing Agents.

Dr. Dinsmore heads his company's  
(Continued on page 124)

# HOW TWO HORIZONTAL BORING MACHINES CAN SAVE TIME ON LARGE WORK . . .



(Above) Triple expansion engine column set up to have ends milled at the same time.

## By Using G. & L. Floor-Type Machines Independently and as a Single Unit

Here is a three-ton 13' 1" column of a triple expansion engine being machined with two G. & L. Floor-Type Machines. Both ends are milled at once, cutting machining time in half. The engine column is blocked and clamped on a plate fixture which is bolted to the machine floor plate.

Subsequent machining operations of the valve slide are shown in drawing at left. This arrangement makes it possible to machine two pieces on a common floor plate.

The nature of your work may be such that it is possible to cut both machining and set-up time using similar equipment. G. & L. engineers would appreciate an opportunity to study your problem and work with you to find its solution. This help creates no obligation. Take advantage of their wide experience in boring, drilling and milling now.

## DETAILS OF JOB

- 1—Load piece No. 1 in "A" fixture on layout floor.
- 2—Load fixture and piece on floor plate. Rough and finish mill ends.  
Load second piece in "B" fixture on layout floor.
- 3—Reset No. 1 piece at 90° for milling surface for valve slides. Set No. 2 piece in "B" fixture for milling surface for valve slides.
- 4—Remove "A" fixture to layout floor and unload. Turn "B" fixture 90° and rough and finish mill both ends.  
Load a third piece into "A" fixture while milling is going on.
- 5—Remove "B" fixture and replace with "A" fixture and repeat all operations until lot is completed.

## Additional Data

...covering the complete line of Giddings & Lewis machines and time-saving accessories is included in this catalog. Write for your copy today—please indicate your business connection. Ask for Bulletin No. TE74.



(Top, above) Engine column and valve slide, with ends ready for milling cut.

(Above) Arrangement of column for milling valve slide. Each column is mounted on a separate plate fixture and is milled individually.



# GIDDINGS & LEWIS MACHINE TOOL CO.

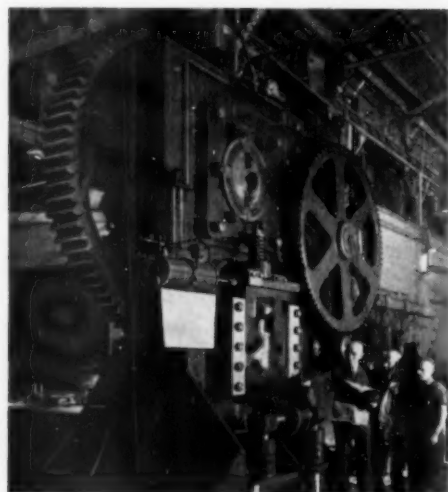


# PRODUCTION PIX

WHAT'S DOING IN THE WORLD OF MASS MANUFACTURING

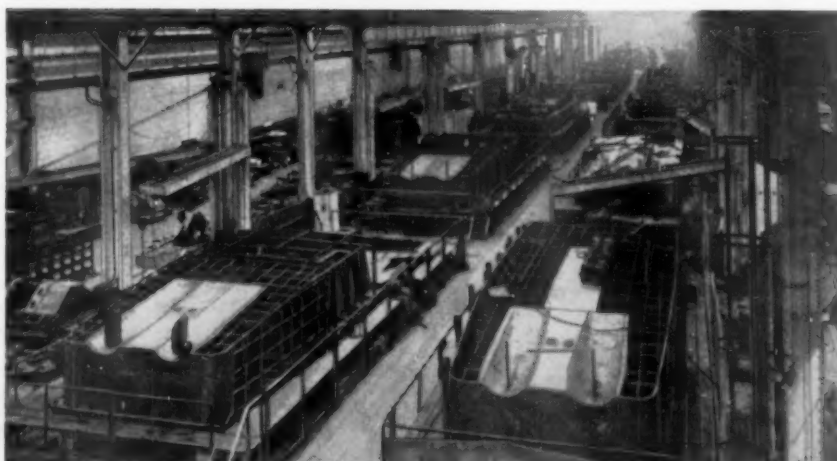


*Above:* Production time on "constant velocity" universal joints has been cut 75 per cent at Bendix Aviation Corporation. This special milling machine cuts the exact curve required for ball-bearing races inside the joint yoke forging.



*Left:* Capable of cutting six 10" steel bars a minute, this new giant Buffalo billet shear has speeded production of forged steel parts at the Melvindale, Michigan, plant of Timken-Detroit Axle Company.

*Below:* Tank landing barges are built upside down in fabrication jigs on this assembly line at the Warren City Manufacturing Company. The Diesel-powered barges are 50' long, 14' wide, and weigh 25 tons.



## INDUSTRIAL NEWS DIGEST

(Continued from page 123)

Research and Development Department.

"It is quite probable," said the scientist, "that the new synthetic industry will prove almost as great a stimulus to the industry's future progress as did the advent of the popular-priced automobile."

Projecting an estimate of rubber requirements of the United States through 1948, and of the world rubber supply and demand through 1950, Dr. Dinsmore proceeded on "the basic assumption that the war will be essentially completed, by a United Nations victory, by the end of 1946."

In this event, he said, present available facts indicate a United States civilian need of 1,010,000 tons in 1948, a figure which compares with this country's highest previous consumption of 783,000 tons in 1941.

Estimating potential American requirements for the next four years, Dr. Dinsmore set 1947 as the peak of passenger tire production in that period, with a total of 80,000,000 such tires being needed in that year for both original equipment and renewals. The peak of truck tire production in the same period was set as arriving in 1948, with a total of 13,400,000.

Considerable increases also were forecast for consumption of rubber in mechanical goods and footwear production, as well as for other civilian uses, some of which will be new while others will continue prewar developments.

In these categories, the scientist said, are rubber spring suspension to replace steel springs for automobiles, vibration dampeners for industrial machinery and railroad trains, latex sponge rubber for cushioning seats and mattresses, rubber tires for farm implements, and rubber as a base for lacquer, adhesives, plastics and packaging materials.

During the four years following the assumed date of the war's end, Dr. Dinsmore estimated, the world's rubber demand may rise to 1,900,000 long tons by 1950, with a total supply in that year of 2,600,000 long tons with which to meet it. Of this supply 1,075,000 tons will be the product of American synthetic plants, 25,000 tons will be wild rubber and 1,500,000 tons will come from cultivated plantations.

"In order to estimate the availability of rubber," the Goodyear official stated, "we must consider the plantation situation. It is expected that after complete repossession, the first year will not produce over 400,000 tons of rubber and the second year not more than 700,000 tons. It may require two years to reach 1,500,000 tons output."

Then, Dr. Dinsmore blasted the pessimistic outlook which visualizes a tremendous postwar investment in unusable synthetic rubber plants. "Granted the validity of our reasoning thus far, the world may be facing a tight rubber situation for nearly four years after the war, unless we see fit to expand further our synthetic output."

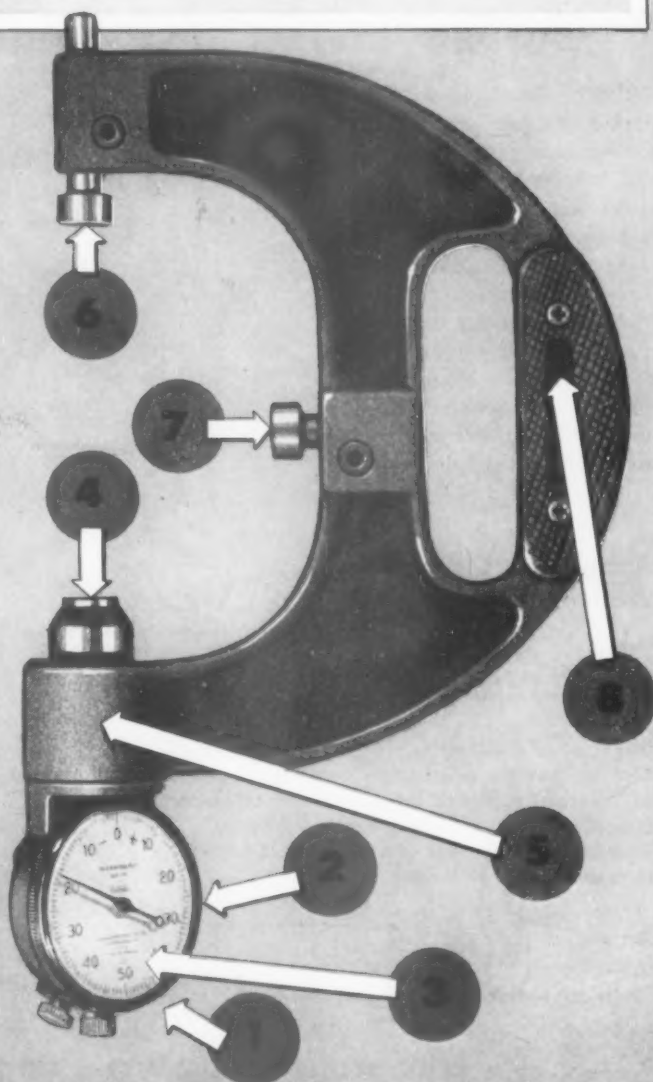
"This is quite a different view from (Continued on page 126)



# SHEFFIELD

## DIAL INDICATOR SNAP GAGE FOR INSPECTION AND CLASSIFICATION

- 1 Gage may be used with dial either at the bottom or the top, whichever is more convenient.
- 2 Dial is adjustable radially and can be swung through 360° to facilitate reading.
- 3 Scale has a range of .005"—each graduation .0001".
- 4 Movable anvil is spring urged for constant gaging pressure, but spring has no effect on indicator. Special spring pressures available.
- 5 Movable anvil bearing is long enough to preserve alignment with the fixed anvil.
- 6 Fixed anvil is adjustable to a maximum of one inch.
- 7 Adjustable backstop has a cylindrical face for accurate line contact.
- 8 Comfortable handle with plastic grip to insulate gage from heat of inspector's hand.



Work may be gaged to the accuracy of a one "tenth" indicator without removing it from the machine.



### THE SHEFFIELD CORPORATION

*Layton 1, Ohio, U.S.A.*

MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

(Continued from page 124)

the one frequently expressed that, Postwar, the market will be flooded with cheap crude which will drive synthetic out of existence. It is important, because it means that synthetic must not only meet out war needs, but must be able to cope with a large portion of our postwar requirements and all the changed conditions under which rubber products will be used.

It is likewise evident that synthetic has five or six more years in which to become competitive, in cost and quality, with the natural product. Can any informed individual doubt that this is sufficient time?"

More synthetic rubber also means more need for other material.

Dr. Dinsmore warned that if the consumption of synthetic is to reach the point indicated, many necessary materials must be provided in large quantities beyond the present emergency war period. These materials include carbon black, rubber accelerators and rayon fabric. The productive capacities of some of these items are normally inadequate, and now are being supplied by converted industries.

"Manufacturers of these materials have been reluctant to plan permanent expansions in view of the general belief that they would be superfluous after the war. Such manufacturers and their customers would do well to reconsider the whole situation in the light of a more permanent demand," the Goodyear official pointed out.

Striking an optimistic note, Dr. Dinsmore predicted that some time between Mid-summer and Fall "the rates of production and consumption will be in reasonable balance and then our crisis will be nearly over."

#### INDUSTRIAL BUSINESS NOTES

##### News of Industry Expansions, Services, and Activities

**Finishing School:** Devoted to the instruction of industrial finishers, four one-week training sessions for spray painters, have been announced by the DeVilbiss Company, Toledo. With class room instruction and shop work under the direction of company-trained spray-painting experts, the courses will stress faster methods of spray painting. Courses start July 17, August 14, October 16, and November 13. Admittance is free to all users of DeVilbiss products.

**Motor City Office:** Hardinge Brothers, Incorporated, announce the establishment of an engineering and service office at Detroit. Charles Boland, a company employee for eight years, will be in charge.

**Bond Record:** For buying an average of \$87.35 worth of War Bonds during the fourth war loan drive, employees of the Fellows Gear Shaper Company, Springfield, Vermont, have been accorded recognition by presentation of a specially designed Minute Man Flag and a citation for "distinguished services rendered in behalf of

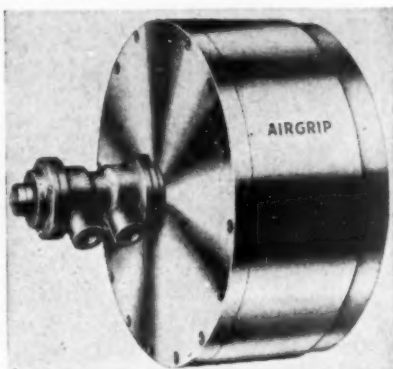
(Continued on page 128)

## Give *WINGS* TO PRODUCTION!

### *"Airgrip"*

#### Revolving Air Cylinders

"AIRGRIP" Revolving Air Cylinders, on double ball bearings permit speeds formerly impossible. Minimum maintenance. Today's top speed and peak efficiency requirements in air chucks demand superior air cylinder performance and service. Under average conditions, the cylinder will run for years without attention. No manual adjustment of packings. Wear automatically taken up by air pressure within the cylinder.



### *"Airgrip"*

#### Chucks

Boost output records, slash costs. "Airgrip" Chucks double gripping power, externally or internally. Work held tight, even if air supply is cut off completely. "Airgrip" 2- and 3-jaw Universal Chucks permit heavier cuts and coarser feeds.



### *"Hi-po"* supercharged

#### Hydraulic Pressure Pump



3000 lb.-Pressure Pump, driven by a 1/2 h. p. motor! Double-Pressure Production; consists of a low-pressure section which supercharges a high-pressure section. Builds up pressure fast, with minimum pulsation.

Write us for Bulletin, and consult Anker-Holth Engineers on pneumatic or hydraulic applications.

## Anker-Holth Mfg. Co.

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# EYE-OPENER

## The New Do ALL Precision Grinder

Tool room precision finishes with a production grinder—surfaces ground to such close tolerances that you can measure them in micro inches—that's what the DoALL offers.

You'll like its quiet, vibrationless performance, its ease of operation. Designed so operator can sit and watch the work at close range without eyestrain or physical discomfort.

And—here's the interesting, modern auxiliary equipment available for use with the DoALL:

**MAGNETIC CHUCK.** Holds work firmly in place with variable amount of magnetic force.

**SELECTRON.** Controls chuck power, demagnetizes chuck, rectifies current, etc.

**COOLANT UNIT.** Steady flow of 1 to 30 gallons per minute.

**DUST COLLECTOR.** Keeps work and table free from dust.

**GRINDING WHEELS.** Perfectly balanced. Various abrasives and grains. Sizes 7 and 10" diameters.

*It will Pay you to Investigate the DoALL now.*

**Send for Illustrated Literature.**

*4.2 R. M. S.  
Guaranteed  
Surface Finish*

*OVER 600 SQ. IN.  
of Bearing Area*

*VIBRATION  
Cut to Minimum*

*DIRECT  
Hydraulic Drive*

Contour Sawing



Band Filer



Super Surface Grinders



Grinding Wheels



Colloidal Cutting Oils



Dust Collectors and Coolant Systems



Variable Speed Pulleys



Band Saws



Band Files



Inspection Laboratory GAGE BLOCKS



POWDER METALLURGY



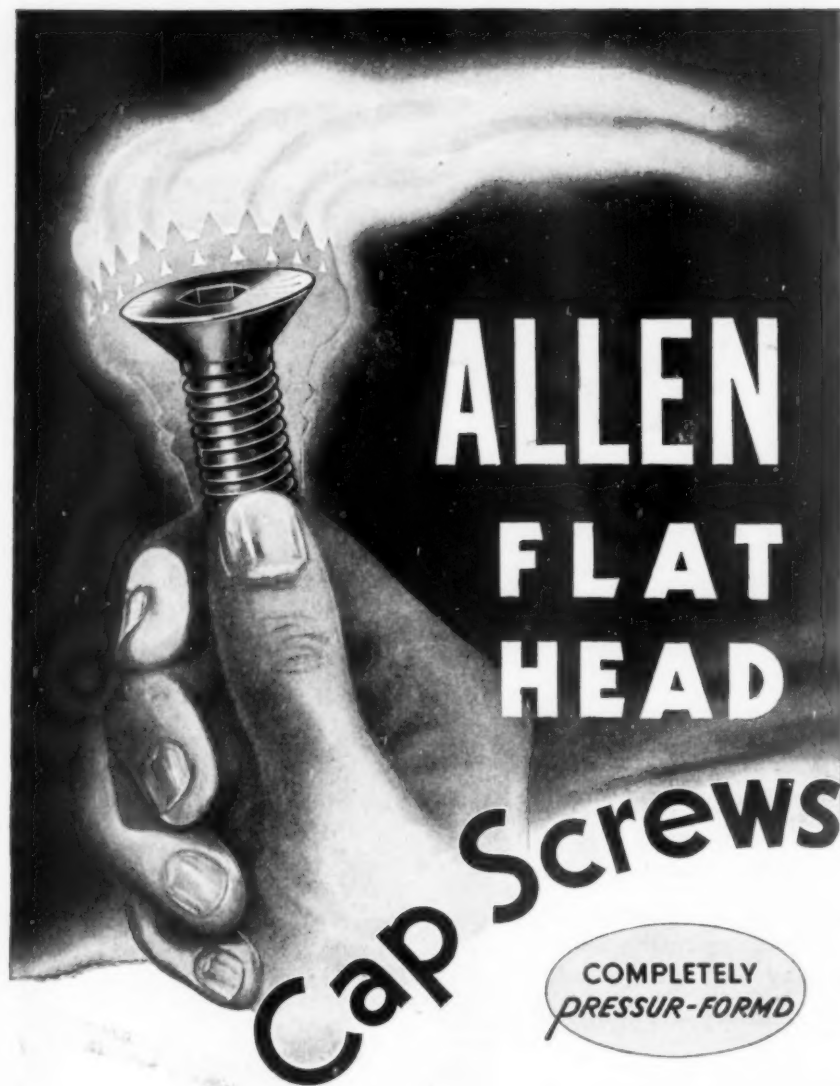
# DoALL

INDUSTRY'S NEW SET OF TOOLS

**CONTINENTAL MACHINES, INC.**  
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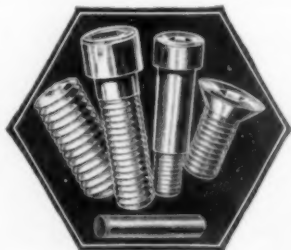
Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, West Hartford.





This Cap Screw design lights your way to attain great rigidity of grip, while attaining flush surfaces of machine parts and assemblies. Sets up flush and true when seated in countersunk hole. It's "pressur-formd" by Allen processes from end to end so the steel-fibres are continuous and uncut under the head, to accentuate strength of the socket.

Threads also are *pressur-formd*, which makes the axial fibres of the steel conform to the contours of the thread profile, with greater resistance to stripping. Thread tolerances are held to a high Class 3 fit, for a high degree of frictional holding-power under vibration



Obtainable as a part of the ALLEN Line from your local Industrial Distributor. Ask for samples, with dimensional data on available sizes. Inquire, too, of your Allen Distributor about advantages of Allen Socket Head Cap Screws, Hollow Set Screws, Socket Head Shoulder Screws and "TRU-Ground" Dowel Pins.

**THE ALLEN MANUFACTURING COMPANY**  
HARTFORD, ★ **ALLEN** ★ CONNECTICUT, U.S.A.

## INDUSTRIAL NEWS DIGEST

(Continued from page 126)

the War Finance Program." The aggregate of Fellows employees' bond purchases was \$177,667.

\*\*\*

**Manufacturing Rights:** Acquisition of full manufacturing rights, parts, stocks, and current orders for the U-6 Automatic and Coulter types of thread-milling machines formerly manufactured by the Automatic Machinery Corporation and the Bolton Manufacturing Company, both of Bridgeport, Connecticut, has been announced by Universal Engineering Corporation of Cedar Rapids, Iowa. Also announced is the appointment of H. Earl Fries, as manager of the Machine Tool Division of Universal Engineering.

\*\*\*

**Subsidiary:** Visualizing postwar acceleration of industrial growth in South America, Timken Roller Bearing Company has announced the formation of a subsidiary at Sao Paulo, Brazil. Known as the Timken Roller Bearing Company of South America, the organization will service Timken bearings now operating in South America and will handle engineering development of the company's products in the Latin-American countries.

\*\*\*

**Expansion:** To accommodate an expected postwar business expansion, Newman Brothers, Cincinnati, announce acquisition of another factory designated as Newman Plant No. 2. The building will provide an additional 15,000 square feet of space. The company's normal peacetime product is ornamental and architectural non-ferrous metal work.

\*\*\*

**Office Moved:** Last month this department carried an announcement that the Allen-Bradley Company, Milwaukee, had moved to New York. Actually, only the concern's branch office has been moved, the new location being at 155 East 44th Street, New York City.

\*\*\*

**Appointment:** Perfex Gage & Tool Company, Detroit, has appointed Gilbert Morgan as company representative in the Chicago territory. His office will be at 30 N. LaSalle St.

\*\*\*

**Milestone:** Commemorating its half-century of industrial growth, Cleveland Pneumatic Tool Company, celebrated its fiftieth anniversary during June with all of its peacetime products being turned out for military use.

Founded as the Union Electric Company in 1894, the company changed its corporate name to the present one in 1899 and facilities were developed for distribution of pneumatic appliances. Since then two subsidiaries, The Cleveland Rock Drill Company, and the Cleveland Pneumatic Tool Company of Canada, Ltd., have been organized.

\*\*\*

**Branch Office:** Hartford, Connecticut, is the site of the newest district office opened by the Cleveland Automatic Machine Company. Under the managership of W. O. Aldrich, formerly a special representative at the Cleveland office, the new branch will assume responsibility for part of the territory formerly handled out of Newark. The

(Continued on page 130)

PRONOUNCED JER-O-TOR

REG. U. S. PAT. OFFICE

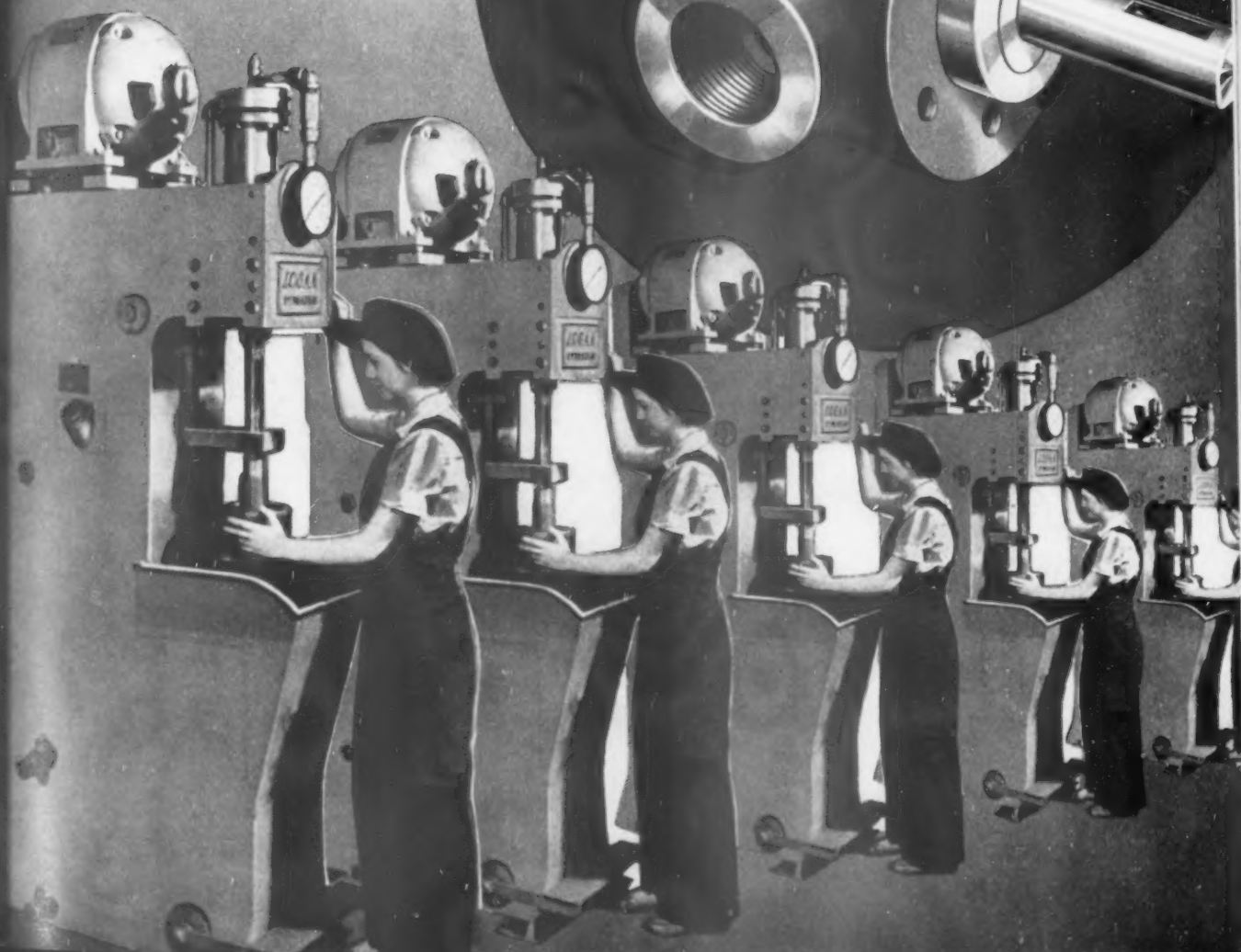
# GEROTOR

## LIQUID PUMPS

LOGAN HYDRAULIC PRESS...  
another example of Gerotor's  
service to the industrial field.  
Behind Gerotor is a council of  
skilled engineers available to  
help you solve war production  
problems — or to assist you in  
post war planning.

May we serve you, too?

GEROTOR DIVISION  
May Oil Burner Corporation  
Baltimore-1, Maryland



# USE THIS TEAM-OR ANY PART OF IT

*Designers*  
TO PLAN IT!

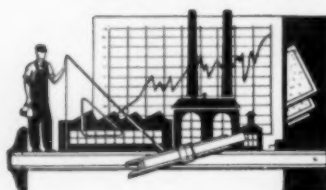
*Engineers*  
TO TOOL IT UP!

*Production*  
MEN TO MAKE IT GO!

*Superintendents*  
TO KEEP IT ROLLING!

*Accounting*  
DIRECTION TO MAKE IT PAY!

**No Job Too Big-No Job Too Small**



**PIONEER**  
ENGINEERING & MANUFACTURING CO.  
19645 JOHN R STREET • DETROIT 3, MICHIGAN

(Continued from page 128)

change is designed to facilitate the company's sales and service contacts.

**Purchase:** Acquisition of Wilson Mechanical Instrument Company, Incorporated, sole maker of the "Rockwell" Hardness Tester, has been announced by American Chain & Cable Company, Incorporated, of Bridgeport, Connecticut. Charles H. Wilson will continue with the business under the new setup.

**Agency:** Rolled Thread Die Company has named the George Keller Machinery Company, Buffalo, exclusive distributor for its Western New York State territory. The organization will handle RTD thread rolling dies and Reed cylindrical die thread rollers. C. G. Briggs Machine Tool Company, Incorporated, Syracuse, will serve as distributor for Central New York and northern Pennsylvania.

**Modernization:** Monarch Aluminum Manufacturing Company has announced authorization of a Defense Plant Corporation contract, totaling \$145,000, for installation of new production equipment in its permanent mold foundry.

The face-lifting job will include installation of straight line production equipment for increased capacity, improved ventilation, new furnaces, additional controls and other automatic devices, and a continuous conveyor belt for quick handling and inspection of castings.

**Labor Management:** Said to reflect its labor management cooperative policy, partial ownership of Progressive Welder Company stock has been transferred to shop and office employees through individual stock purchases.

Employee representatives have been named to the Board of Directors. The stock acquisition is described as an adjunct to the company's year-old employee's profit-sharing plan.

**Citations:** Employees of the Quick Meal Division of the American Stove Company, St. Louis, have been presented the Army-Navy "E" for excellence in war production. The company's war products include important aircraft and ordnance items.

Another recent "E" award winner is Danly Machine Specialties, Incorporated, Chicago, for high production turned out by employees on war materials.

For development and manufacture of special electrical equipment for the Maritime Commission, employees of Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., have been awarded the "M" burgee and the Victory Fleet flag. The company now is a division of Joshua Hendy Iron Works.

**Name Change:** To eliminate confusion of its name with that of other firms, American Screw Products, Los Angeles, will conduct its business under the name of The Deutsch Company. The trade name of American Screw Products will be discontinued.

(Concluded on page 132)



# New Facts

## ON CHUCKING MACHINE WORK

HOW COSTS WERE CUT ON

25

CHUCKING MACHINE JOBS



MULTIPLE SPINDLE CHUCKING AUTOMATICS

This new booklet brings you important details on 25 examples of chucking work — covering a wide range — in which unusual time and money savings have been made.

Your personal copy will be sent if requested on your company letterhead.

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ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES

(Concluded from page 130)

## MOTOR MEMOS

**Completed schedules and impending cutbacks arouse anxiety about re-conversion. WPB OK of the Packard parts program brightens outlook**

DETROIT—Though it suffered some of the most severe work stoppages due to strikes since Pearl Harbor, the automobile industry continued last month to pile up production records unparalleled in mass manufacturing.

Changing war materiel requirements, completion of scheduled production and cutbacks began to affect more individual plants. With current output far exceeding originally estimated capacity, industry production men are expecting the axe momentarily on numerous other programs.

This very condition is tending to create anxiety about reconversion. Interest in retooling in preparation for auto building, previously a front office topic exclusively, is now common shop talk.

Donald Nelson's rush visit to the motor capital early in the month served to heighten speculation about possible WPB approval on plans to commence the ground work where it would not interfere with war production. Nelson came and left without committing himself on the subject.

Some headway was made, nevertheless, by the "let's get started now" advocates. Since automotive parts manufacture is the real problem in getting full scale car and truck production under way, much significance is attached to WPB approval, after months of deliberation, for a \$975,000 Packard expansion and alteration program necessary for that producer to resume parts manufacture.

At the same time, news from Washington of possible early resumption of light civilian truck production was encouraging. Manufacture of light units numbering one half normal yearly output is indicated for 1945, with smaller producers permitted to take a larger share of the total to assure a reasonable profit margin. The program, it is argued, would compensate for current and anticipated aircraft cutbacks in the auto industry.

● **Allison:** The screen of Army censorship has at last been lifted at Indianapolis, permitting announcement that production of the world's most powerful aircraft engine now is underway at General Motors' Allison Division.

With a maximum rating of approximately 3,000 horsepower, the GM-engineered power plant for fighter planes has been described as the most powerful ever to pass official tests at Wright Field. Designated as the V-3420 series, the new unit is of 24 cylinder, liquid-cooled design. Piston displacement is twice the size of that in the standard Allison 12-cylinder engine.

● **Hudson:** The second of two new production programs undertaken by Hudson was revealed during the past month with the announcement that this auto builder now is turning out fuselage sections and wings for the Army's new Boeing B-29 Super-Fortress. The other program, now well under way, is the manufacture of complicated folding wings for Navy dive bombers.

B-29 fuselage sections are built on the same assembly line used by Hudson to produce smaller B-26 Marauder fuselage sections. Within 19 days after the final B-26 work rolled from the line, B-29 sections were shipped from the Detroit plant. This, Hudson engineers say, is proof that automotive changeover methods can be applied to aviation production.

● **Diesel Engines:** Presentation to the Navy of the 100,000th six cylinder two-cycle Diesel engine produced by the Detroit Diesel Engine Division of General Motors last month dramatized the attainment of mass production in a relatively new field.

GM's Series 71 Diesel engine is used to power Navy landing craft. Growth of the Detroit Division has been rapid, and war-time advancements made in product design and manufacturing technique bid well to place this producer in an advantageous postwar position. In 1938 the company turned out only 800 Diesel engines. By 1941, the

Today, Packard is operating on a production volume four-and-one-half times that of its largest annual peacetime automotive output. How this experience will affect the postwar competitive situation in automobiles is a matter of much conjecture in the motor capital. Many an automobile man is saying that the independents will not be satisfied with relatively low production, high-price manufacture. They will tell you that all three of the big independents will go after the low-price trade, will really snap at the heels of Chevrolet, Ford and Plymouth.

In the case of Packard, George T. Christopher, President, recently told newsmen that plant additions for steadily rising Rolls-Royce engine schedules now give the company a total of 4,600,000 square feet of productive factory floor space, exceeding even the area of Willow Run.

Since the start of war production, the company has shipped more than 35,000 engines. This is described as equivalent to 370,000 Packard cars. The latest automotive registration figures show 475,693 Packard cars in owners' hands.

● **Chevrolet:** Now under construction in Tonawanda, New York, is a large addition to the Chevrolet Aviation Engine Plant Number One.

The additional 114,120 square feet of manufacturing space will be devoted to production of a new 18-cylinder Pratt

## HOW LONG FOR RECONVERSION?

"How long after the war before new cars can be produced?"

Based on the assumption that the government and armed forces will cooperate with Detroit plans for speeding the removal of war production tools and the installation of new equipment, leaders of the automotive industry have offered these opinions:

● "Largely dependent upon government action." —A. E. BARIT, Hudson

● "I believe that industry can and will reconvert quickly. We have gone over all

our plants to be ready to reconvert. We have established schedules and completed layouts."

—GEORGE W. MASON, Nash

● "Some cars within three months and a pretty fair production in six months."

—C. E. WILSON, General Motors

● "Four months."

—GEORGE T. CHRISTOPHER, Packard

● "Sixty to 90 days after the termination of the war against Germany."

—M. E. COYLE, Chevrolet

annual production had swelled to 10,000. This year's output will top the last figure many times.

In addition to powering landing craft, GM Diesels are now used in one-, two-, three-, four- and six-cylinder sizes in M-3, M-4 and M-10 tanks, trucks, tractors, bulldozers, and military buses. Biggest peacetime market visualized by the Detroit Diesel Division: Buses, trucks, tractors and industrial application.

● **Packard:** War production has given the independents of the industry new experience in mass production. Nash, Studebaker, Willys and Packard are now cutting metal at a pace far exceeding any they achieved in their best pre-war years.

& Whitney radial engine.

Current production of a 14-cylinder P & W engine, of which the company already has manufactured more than 39,000, also will be maintained in the plant, one of three Chevrolet units in the Buffalo area working on the aircraft engines.

At present, 17 Chevrolet plants in eight cities are devoted to the P & W program. Re-tooling and re-arrangement of facilities already are under way in these plants, all of which will supply parts for the new engine. Because of the increase in size and power of the new unit, no parts are interchangeable with the 14-cylinder job. Consequently, a complete new layout of equipment is necessary, GM officials have explained.

THE END

THE TOOL ENGINEER

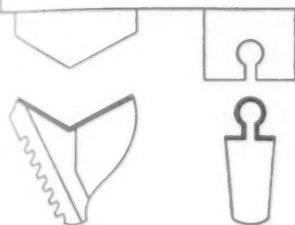
# BROACHING WRENCHES

## 3 Times Faster

### THAN BY FORMER METHOD



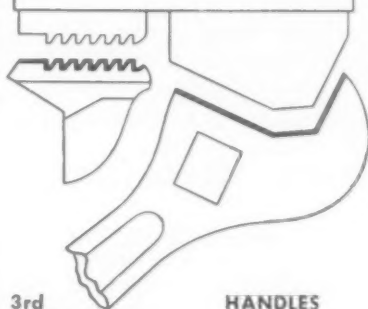
SLIDE No. 1



1st  
OPERATION

2nd  
OPERATION

SLIDE No. 2



3rd  
OPERATION

HANDLES

- ★ FEWER MACHINES
- ★ FEWER MEN
- ★ IMPROVED PRODUCT
- ★ MUCH LOWER COST

FIXTURE NO. 1

FIXTURE NO. 2

The schematic drawing above shows a set-up designed and built by Detroit Broach Company for broaching several surfaces on adjustable open-end wrenches. These operations are performed on a double slide surface broaching machine using hydraulically operated fixtures. Only one man is required to maintain a production rate three times as great as that formerly maintained using several men and several machines. In addition to increasing the speed of production, two surfaces are machined by the broaching method which were not touched by the former method. This set-up is arranged for broaching several sizes of wrenches.

There are operations in nearly every shop where the speed, accuracy and good finish provided by broaching can increase output and improve efficiency. Call in a Detroit Broach engineer. He will give you complete production and cost data on changing to broaching without obligation on your part.



## DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE

DETROIT, MICHIGAN

9308 SANTA MONICA BLVD.

BEVERLY HILLS, CALIFORNIA



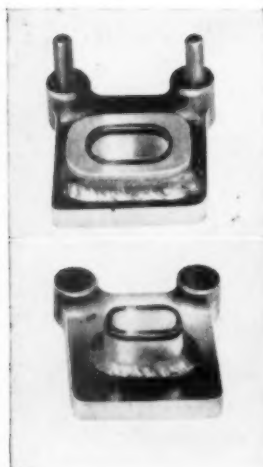


**Eureka TOOL STEEL ELECTRODES**

save vital tool steel for Victory

**Eureka TOOL STEEL ELECTRODES**

save time in Reconversion  
to Postwar Products!



**R**IGHT NOW we are all devoting 100% of our time to the winning of the war, and the Welding Equipment & Supply Company's Eureka Tool Steel Electrodes are doing their part by saving tons of *vital* tool steel, and countless man-hours. This savings is accomplished in the many industries where Eureka Tool Steel Electrodes are being used in the repair and maintenance of Tool and Die sections and the composite construction of new dies by welding.

When *peace* again prevails, Eureka Electrodes will play an equally important part in industry by helping to speed up the reconversion for postwar manufacturing by saving valuable time in the composite fabrication of new dies.

Illustrations at left show fabrication dies with Eureka Tool Steel Electrode deposits used as cutting edges.

★ If you are making postwar plans now, we invite you to write us for complete information on Eureka Electrodes today. ★

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE UNITED STATES AND CANADA

**WELDING EQUIPMENT & SUPPLY CO.**

223 LEIB STREET

DETROIT, MICHIGAN



### IT TELLS ALL!

For complete information on how to use Suttonite No. 1 and a newly developed No. 2, in your plant for the reclamation of high speed steel cutting tools, write for this folder today.

### PRODUCTION ROUND-TABLE (Concluded from page 105)

"and failure to adopt this policy is the reason many small producers complain about production costs."

Merry said that "when a machine tool is not written off the books on a dollars and cents basis, it may have lost its value through inability to meet or maintain precision standards."

If a part can be made cheaper through the use of some other type of machine, the old machine must be disposed of, he said. Then, he added, a machine may become antiquated in the light of future production programs.

"The smart manufacturer will not buy second hand machinery because it is cheap," the Hartford executive said, "but he will buy machine tools only because—new or second hand—they will produce cheaper. He will always weigh a machine tool against the cost of the product he must turn out."

In one of the most ambitious editorial projects undertaken by the technical trade press, the Editors of The Tool Engineer magazine have travelled from coast to coast to secure at their PRODUCTION Round-Tables an accurate summary of thinking among top-flight production engineers.

Further to substantiate these observations on current and postwar machine tool requirements, industrial skills, new materials, and fabricating techniques, The Bramson Publishing Company is planning additional Round-Tables. Scheduled for publication next month is a Round-Table in Buffalo, New York. THE END

### 6 DAYS DELIVERY

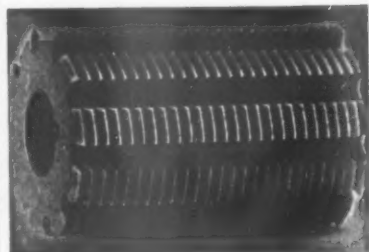
on

### THREAD MILLING CUTTERS (HOBS)

### EXPANSION- AND RADI- AL RELIEVED FORM CUTTERS,

Regular or interrupted  
tooth form

### CIRCULAR THREAD CHASERS



### INVOLUTE SPUR GEAR CUTTERS

14½°; 20° & 25° P. A.

Send Blueprints and Specifications

**U. S. MACHINE TOOL MFG. CORP.**  
Clinton, Indiana Phone 85

*"Our costs - like our work - are set to very close limits. In checking up, we found these L & S Duomatics combine top production with minimum maintenance."*

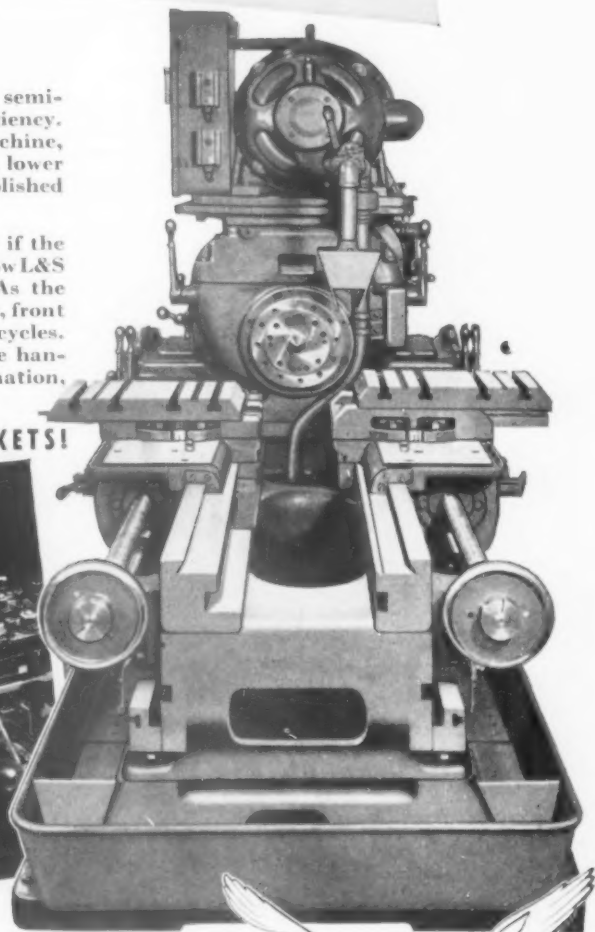
In thousands of war plants today, large numbers of unskilled and semi-skilled workers operate L & S Duomatic Lathes with amazing efficiency. Automatic controls, shifting responsibility from worker to machine, permit production in greater volume—with improved quality—at lower cost. Such performance a few years back could have been accomplished only by operators of the highest skill.

If your shop is equipped with old or worn lathes, and particularly if the manpower shortage requires hiring of unskilled personnel, learn how L & S Duomatics can help you maintain full production schedules. As the name implies, the 3-A Duomatic has dual carriages and cross-slides, front and rear, operating singly or together on the same or on different cycles. Automatic controls permit exact duplication of sizes and accurate handling of large or small quantities of work. For complete information, write for literature or call on Lodge and Shipley Engineers.

#### PREPARE FOR THE COMING BATTLE OF MARKETS!

● Make your plans now for "the way back" to peacetime production. Aim to hit full stride with least delay. Thus, when purchasing a new lathe needed for wartime output, consider also how well adapted it is for future use. Here L & S "engineering foresight" can be of practical help by its proved capacity to build lathes adaptable for varied service through the years. This engineering foresight—result of 52 years specialized lathe experience—makes your wartime Duomatic equally efficient for peacetime use.

ENGINE  
AUTOMATIC  
TOOL ROOM  
OIL COUNTRY  
LATHES



THE **L** **O** **D** **G** **E** & **S** **H** **I** **P** **L** **E** **Y** MACHINE TOOL CO

CINCINNATI 25, OHIO, U. S. A.



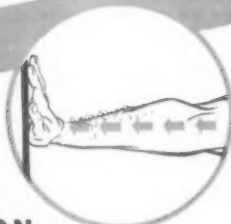


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When T-J Air or Hydraulic Cylinders "take over" a job of power movement...experienced shop men know these Cylinders will deliver top efficiency in every stroke!

Whether it's a mechanical movement requiring pressure to clamp...press...raise...or shift—T-J Cylinders do the job *right*! Designed for compactness, these Cylinders are accurately machined for correct

mounting and highly efficient performance. Cylinder bores are honed to accurate concentricity, then hard chrome plated. Available in many standard sizes and styles...both cushioned and non-cushioned types. T-J engineering and skilled workmanship assure utmost dependability. Send for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.



FOR TOUGH JOBS SPECIFY

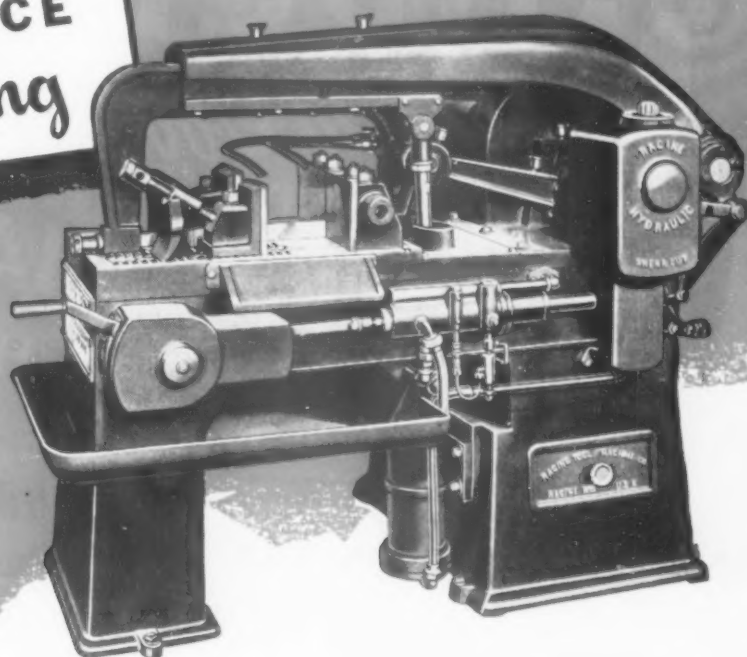


# TOMKINS-JOHNSON

RIVETORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHERS



# PRODUCTION AND MAINTENANCE *metal cutting*



## with **RACINE** hydraulic **HEAVY DUTY METAL** saws

The Racine Heavy Duty Production Saw has a progressive combination "Positive" and "Flexible" hydraulic feed. The "Positive" feed predetermines cutting time. Each cut, even though it be made in tough alloys or tool steels, is made in exactly the same length of time.

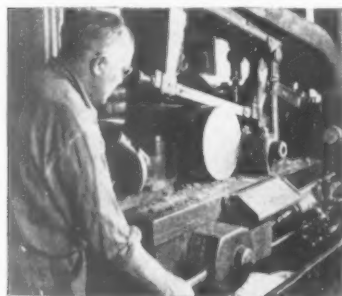
The "Flexible" feed permits blade to cut faster when resistance is reduced. Faster cutting is attained in round bars, tubing, through the thin section of structurals and other shapes, by the use of this feed. This progressive combination "Positive" and "Flexible" feed is exclusive with Racine.

Racine's complete saw line includes a wide range of machines. Models are available to meet the varied requirements of all metal working industries. Capacities from 6" x 6" to 20" x 20".

Write for complete catalog and time study of your work. Address Dept. **TE-S**.



Flexible hydraulic feed speeds the cutting of this large I-beam.



Hydraulic operation insures fast accurate cutting of heavy bars.

## **RACINE OIL HYDRAULIC PUMPS AND VALVES**

Racine "Variable Volume" Oil Hydraulic Pumps and "Balanced Piston" Valves provide special advantages for hydraulic circuits in a wide variety of applications. Pump capacities of 12-20 and 30 G.P.M. Operating pressures 50 to 1000 lbs. Valves in all sizes to 1½". Write for Catalog P-10-C today.



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**TOOL and MACHINE  
COMPANY**

Standard for Quality  
and Precision

RACINE, WISCONSIN  
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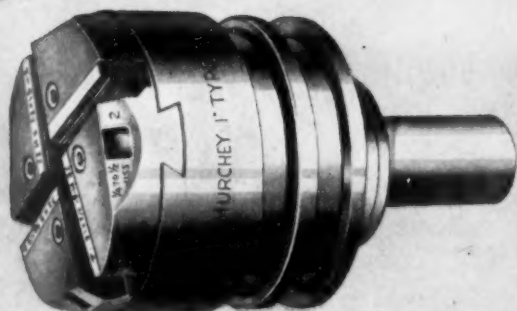


KEEPING AHEAD OF THE TIMES

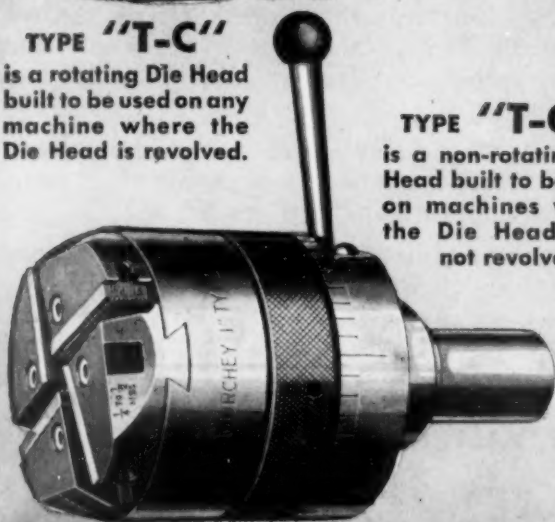
# MURCHEY

*Now Offers*  
NEW AND IMPROVED  
**TANGENT CHASER**  
SELF OPENING DIE HEADS!

GREATER ACCURACY—LONGER LIFE



**TYPE "T-C"**  
is a rotating Die Head  
built to be used on any  
machine where the  
Die Head is revolved.



**TYPE "T-G"**  
is a non-rotating Die  
Head built to be used  
on machines where  
the Die Head does  
not revolve.

**M**ANUFACTURED of Special Alloy Steel, hardened and ground throughout, these Die Heads (Model "T" series) are expressly made to cut accurate threads on long production runs. They are designed to use Tangent Chasers—giving long chaser life; permanent throat; uniformity of finished work throughout the entire life of chasers and interchangeability of chasers.

*Send for literature*

*Also ask for literature on Collapsible Machine Tap; Self Opening Die Heads; Thread Milling Machines; Tapping Machines and Roller Pipe Cutting-off Machines.*

**MURCHEY MACHINE & TOOL CO.**

Department T

DETROIT 26, MICHIGAN

# MURCHEY

**the CONE AUTOMATIC MACHINE COMPANY**



*sees many*

**GOOD THINGS AHEAD**

### *It is reported that:*

The world's most powerful electric motor has recently been completed. Developing 7,000 horsepower at only 25 r.p.m., it is said to be capable of lifting an entire four stack destroyer at the rate of 200 feet per minute.

get ready with CONE for tomorrow

A new resin dip for small metal parts feels like rubber, protects the part, strips easily by hand and may be re-used.

get ready with CONE for tomorrow

A new invention consists of a panel that hangs over a bed and is a source of radiant energy. Properly adjusted to the sleeper's metabolism and length of slumber, it is expected to give him the equivalent of a full night's sleep in as little as two hours.

get ready with CONE for tomorrow

The rare metal, indium, is being used as a tarnish-proof plating for gold and silver and is being used as an alloy in bearing metal and solder.

get ready with CONE for tomorrow

A new chemical does most of the work of the dangerous hydrofluoric acid without danger to the human skin.

get ready with CONE for tomorrow

The new plastic-coated fabrics will be water-proof and abrasion-resistant and may be flexed for a long time before cracking. They will be useful materials for baby carriages, auto tops, furniture, bus seats, shoe tips, raincoats, luggage, shower curtains and handbags.

get ready with CONE for tomorrow

Even the high-pressure cylinders used to hold compressed gases are now being made by stamping and drawing.

get ready with CONE for tomorrow

A colored surface .0001 inch thick, applied to the surfaces of gages does not affect their accuracy, but warns of wear by a change in color.

A national producer's council hopes to reduce the cost of home building by 20% by promoting more modern building codes and labor regulations.

get ready with CONE for tomorrow

The by-products of sawdust have become so valuable that some sawmills are using coal for fuel.

get ready with CONE for tomorrow

A prominent scientist states that it may take twenty years to utilize fully the scientific discoveries made since Pearl Harbor.

get ready with CONE for tomorrow

A synthetic shellac made from corn is expected to permanently replace the natural product which is made from the secretions of an insect found in India.

A large manufacturer of farm machinery proposes to enter the peace-time farm market with a line of refrigerators and cold storage lockers.

get ready with CONE for tomorrow

A new low-temperature grease permits aerial cameras to operate at temperatures as low as 100 degrees below zero.

get ready with CONE for tomorrow

A French automobile manufacturer expects to make a small, economical car for the American post-war market.

get ready with CONE for tomorrow

A maker of paper parachutes, for dropping supplies to troops, expects to continue their manufacture after the war for use in the air delivery of mail and light-weight express.

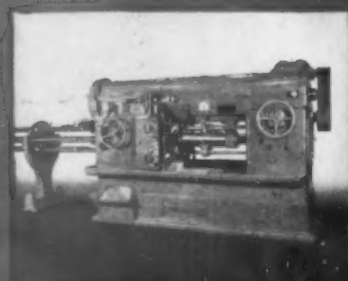
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The world's shortest firing range, only twenty-two feet long, duplicates the air pressure and temperature of the stratosphere.



*Here is performance  
that is definitely  
AHEAD*

**This part calls for extreme accuracy and yet requires wide forming cuts on a variety of diameters. In one position an attachment taps an inside thread 5/16"-18 while, at the same time, a die cuts an outside thread 5/8"-27. Produced on the 6 Spindle Conomatic at the rate of 12.5 seconds per part.**



**CONE**

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.



# GLENCO

## FLOATING TOOLHOLDER

*Corrects Machine Tool Misalignment By  
Producing TRUE and ACCURATE Holes*



Also Manufacturers of

**Utility  
Tools**

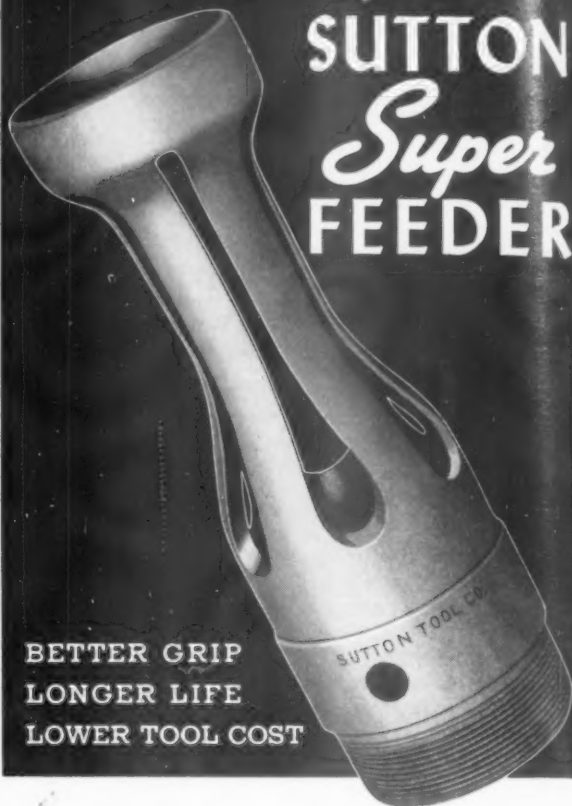
FLOATING  
HOLDERS  
SPOTFACERS  
COUNTERSINKS

REAMERS  
COUNTERBORERS  
LIVE CENTERS  
SLEEVES  
TAP CHUCKS  
DRILL CHUCKS  
ADJUSTABLE  
ADAPTERS  
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EXTENSION  
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QUICK CHANGE CHUCKS  
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**THE J. C. GLENZER CO.**  
DETROIT MICHIGAN

GET Super PERFORMANCE  
WITH THE *New*

# SUTTON *Super* FEEDER



BETTER GRIP  
LONGER LIFE  
LOWER TOOL COST

● Try this new Sutton Super Feeder on your automatic screw machines. Round, square or hex stock is held by multiple steel springs in compression (not in tension as in ordinary feeders); gripping pressure is exerted all around stock, uniform grip is spread over large area—less stock marring—less wear on feeder; a few hammer taps restore spring tension and compensates for possible wear, giving longer life, lower tool cost.

**COSTS NO MORE THAN ORDINARY FEEDERS**

## SUTTON TOOL COMPANY

2895 W. Grand Blvd., Detroit 2, Michigan

Send for Bulletin No. 11. See Our Representative

# SUTTON



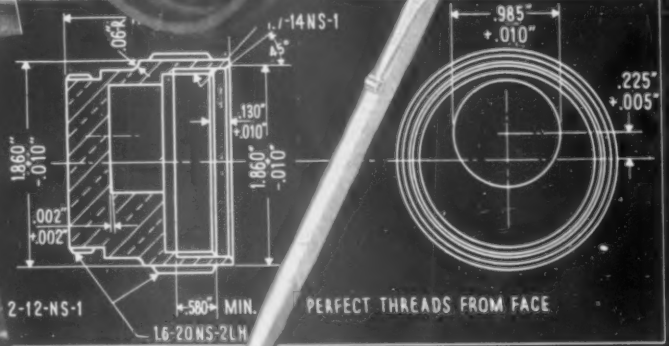
# COLLETS

THE TOOL ENGINEER

# BOOSTING PRODUCTION OF BOOSTER BODIES WITH GREENLEE 6 SPINDLE AUTOMATICS



15 Operations Completed in Record Time. Gross Production Rate — 400 Per Hour or 9 Seconds Per Piece.



## SCRIPTO MFG. CO. SETS FAST PRODUCTION PACE

### INDEPENDENTLY OPERATED CROSS-SLIDES PERMITTED EFFICIENT TOOLING SET-UP

Photos above show tooling set-up used to produce booster bodies. Cross-slides are independently operated by separate cams — make possible efficient tooling set-ups.

#### Sequence of Operations

- 1 Drill large diameter. Rough form two small diameters — turn large outside diameter.
- 2 Bore large diameter. Form O. D. Face and chamfer end of piece.
- 3 Rough bore eccentric hole. Shave outside diameters.
- 4 Roll thread on small O. D. Finish bore eccentric hole.
- 5 Cut thread on large O. D. Chamfer and break down for cut-off.
- 6 Tap inside thread. Cut-off.

Gross Production Rate — 400 per hour

Scripto Mfg. Co. — producers of world famous, high quality mechanical pencils for consumers and industrial users — has established a noteworthy record in production expediting with two Greenlee 6-Spindle Screw Machines. Their net machine output of brass boosters, a shell fuse part, set a fast production pace over a 2½ year period. Here is typical production data characteristic of Scripto's efficient methods of operation which has won them the Army-Navy "E" Award:

Month	Scheduled Operating Hours	Net Production Efficiency
April.....	638.....	78.0%
August.....	626.....	71.5%
September.....	528.....	74.6%

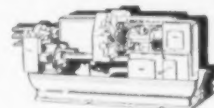
NOTE: All time losses for tool adjustments, breakage, mechanical failures, etc. are included. Due to high rate of production, approximately 10% of downtime is required for stocking.

For this kind of performance, credit is also due Scripto operators. With no multiple-spindle experience and with as little as 3 months' training on single-spindle machines, they quickly acquired the skill to maintain the Greenlees on continuous production. Mechanical features on the Greenlee — *simplicity of design and ease of tool adjustments* — offer surprising aid today under war-time conditions and promote efficiency on many short as well as long run jobs:

Write today for full facts.



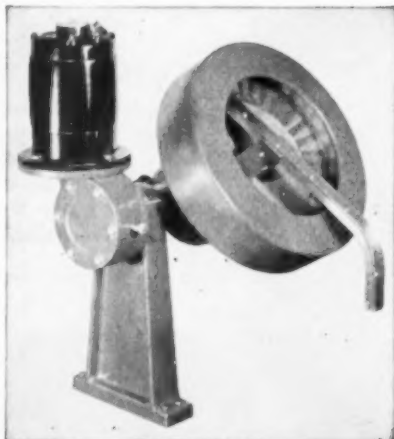
**GREENLEE BROS. & CO.**  
1947 MASON AVENUE, ROCKFORD, ILLINOIS



# GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

# HOPPERS and SCREWDRIVERS



FASTEST FEEDING HOPPER  
EVER DESIGNED!

ADAPTABLE TO ANY  
MACHINE!

NO JAMMING OR LOCKING!

HOPPER FEEDS: Bullet Cores,  
Rings, Pins, Rivets, Nuts, Screws,  
Discs, and Special Parts.

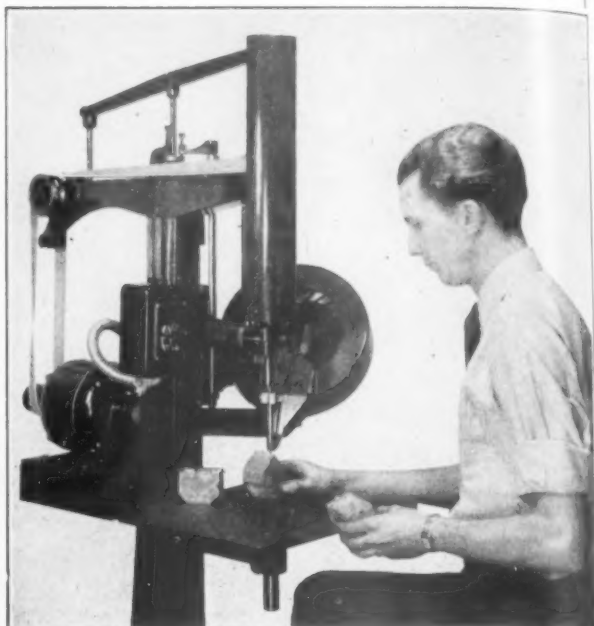
DRIVE SCREWS  
the  
MODERN WAY

REDUCE COSTS  
INCREASE  
PRODUCTION

THREE MODELS

No. 2 to  $\frac{3}{8}$  Screws

*Send Samples  
For Production  
Estimates*



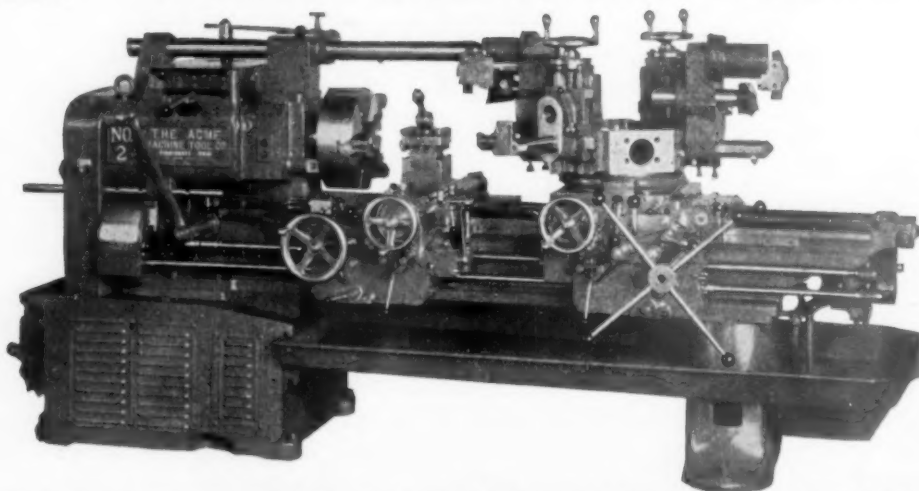
**DETROIT POWER SCREWDRIVER CO.**

2805 W. FORT STREET

DETROIT 16, MICHIGAN

CINCINNATI  
**ACME**  
UNIVERSAL  
TURRET LATHES

## SPEED PRODUCTION--SAVE TIME



**GREATER RIGIDITY AND ACCURACY UNDER HEAVIER CUTS AT FASTER SPEEDS!**

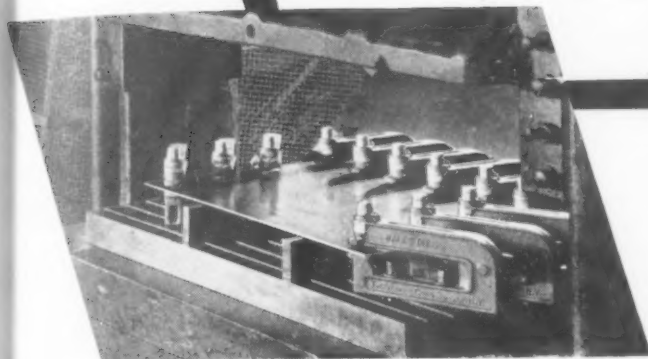
The above illustrated No. 2 ACME Universal Turret Lathe with its stationary overhead pilot bar and headstock brackets together with rigid turret tooling permits heavy multiple cuts. These features assure accuracy while faster speeds are possible through the use of cemented carbide cutting tools. This machine features heavy duty multiple turning heads and vertical side tools and heavy duty reversible cutter holders. Also shown is the lead screw type chasing attachment with split nut brackets and threading dials on both carriages.

• WRITE FOR COMPLETE DETAILS.

**THE ACME MACHINE TOOL CO.** 4955 SPRING GROVE AVE., CINCINNATI 32, OHIO



# BEFORE YOU PUT HOLES IN SHEETS ANGLES CHANNELS



Wales Type "B" Units for punching sheet material in stamping presses

BY any METHOD . . . investigate

## WALES HOLE PUNCHING EQUIPMENT

Before spending valuable time and effort designing and building special hole punching dies, check with Wales-Strippit engineers who may have solved your particular hole punching problems by using various adaptations of standard Wales Hole Punching Units.

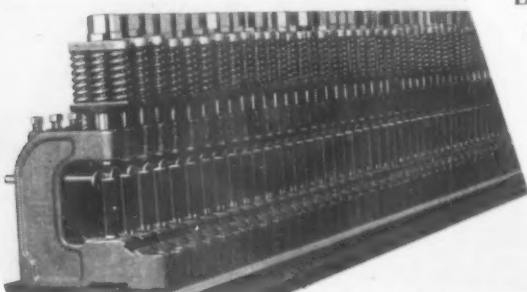
Join the hundreds of metal fabricators who make it a rule to call on Wales-Strippit *before* putting holes in sheets, channels, and angles by *any* method.

As a timely suggestion, call on Wales-Strippit *FIRST*.

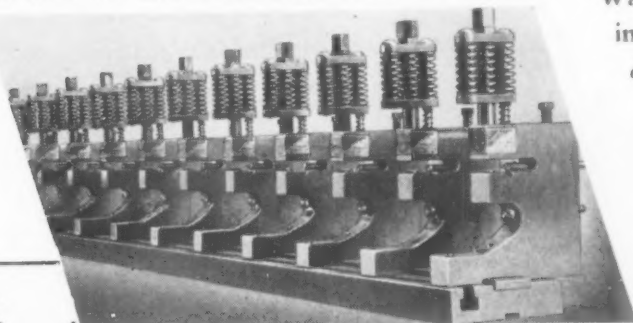
Write for Catalogs

### TIME- SAVING MONEY- SAVING FEATURES

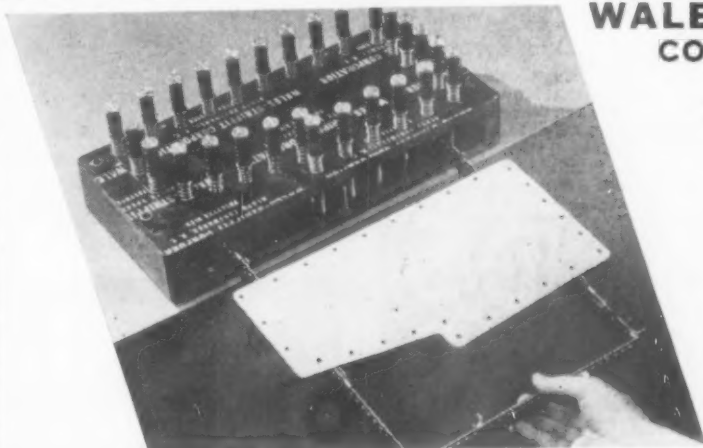
1. Usual time-consuming adjustments of conventional set-ups are eliminated
2. Punch and die held in perfect alignment by holder
3. Each unit is independent and self-contained
4. Straight line, staggered or scattered patterns, punched with same units
5. Same group of units may be used interchangeably on press brakes and stamping presses
6. Nothing attached to press ram
7. Individual units may be instantly removed or reset
8. Punches may be interchanged without disturbing set-up
9. Die setting and press "down time" reduced to minutes
10. Same units may be used and re-used in unlimited patterns



Wales Type "C" Units designed for punching angles and sheets on press brakes



Wales Type "E" Units to punch extruded shapes and channels on press brakes



Wales Plate Set System punches holes in sheets as close as 1/2" center-to-center in any direction over the entire sheet

## WALES-STRIPPIT CORPORATION

353 Payne Avenue

NORTH TONAWANDA  
N. Y.

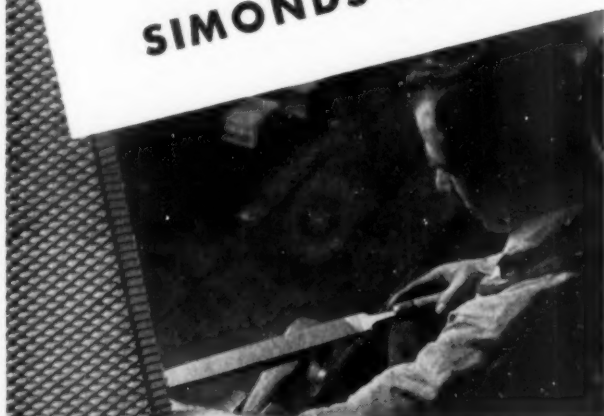
(Between Buffalo and  
Niagara Falls)

GEORGE F. WALES,  
President

Specialists in Punching  
and Notching  
Equipment

He does Faster Filing  
With Less "Elbow-Grease"

...because  
**SIMONDS** <sup>RED TANG</sup> **FILES**  
have teeth like  
**SIMONDS SAWS**



Chips roll easily off the teeth of Simonds Files, just as they do from the bits of machine tools... long, spiral chips that mean smooth, easy cutting instead of scraping that leads to quick fatigue. And Simonds Red Tang File teeth are not only fast-cutting... they're long-lived as well, because they're designed and shaped like the teeth of Simonds Metal-Cutting Saws. So you can bank on Red Tang Files to cut more metal with each stroke... and to stay sharp longer. These files are made in only one quality, A-1. Order them from your Industrial Supply Distributor, or from the nearest Simonds office:

**BRANCH OFFICES:**

1350 Columbia Rd., Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 228 First Ave., San Francisco 5, Cal.; 311 S.W. First Ave., Portland 4, Ore.; 520 First Ave. So., Seattle 4, Wash.; 31 W. Trent Ave., Spokane 8, Wash.

SHORTEN THE WAR  
... BUY BONDS!



**SIMONDS**  
SAW AND STEEL COMPANY  
FITCHBURG, MASSACHUSETTS

PRODUCTION TOOLS FOR CUTTING METAL,  
WOOD, PAPER, PLASTICS



*This*  
**HANDY  
HONE**  
Keeps Tools Keener  
Gives Longer Service

**T**OOLS last long, retain their cutting accuracy, require fewer regrinds when sharpened and polished with Tamaloy Diamond Hones. An occasional touching up while tool is still in the machine is usually all that is needed to maintain correct tool surfaces.

Handy pocket size. Convenient shape, easy to get into narrow spaces. Effective on any metal, including carbides.

Diamonds, bonded into tungsten carbide, do not work loose or fall out, nor does the bonding crumble or quickly wear away. Tamaloy Hones give as much as fifty times as long service as plastic-bonded diamond hones. Three grades—100, 150 and 200 grit.

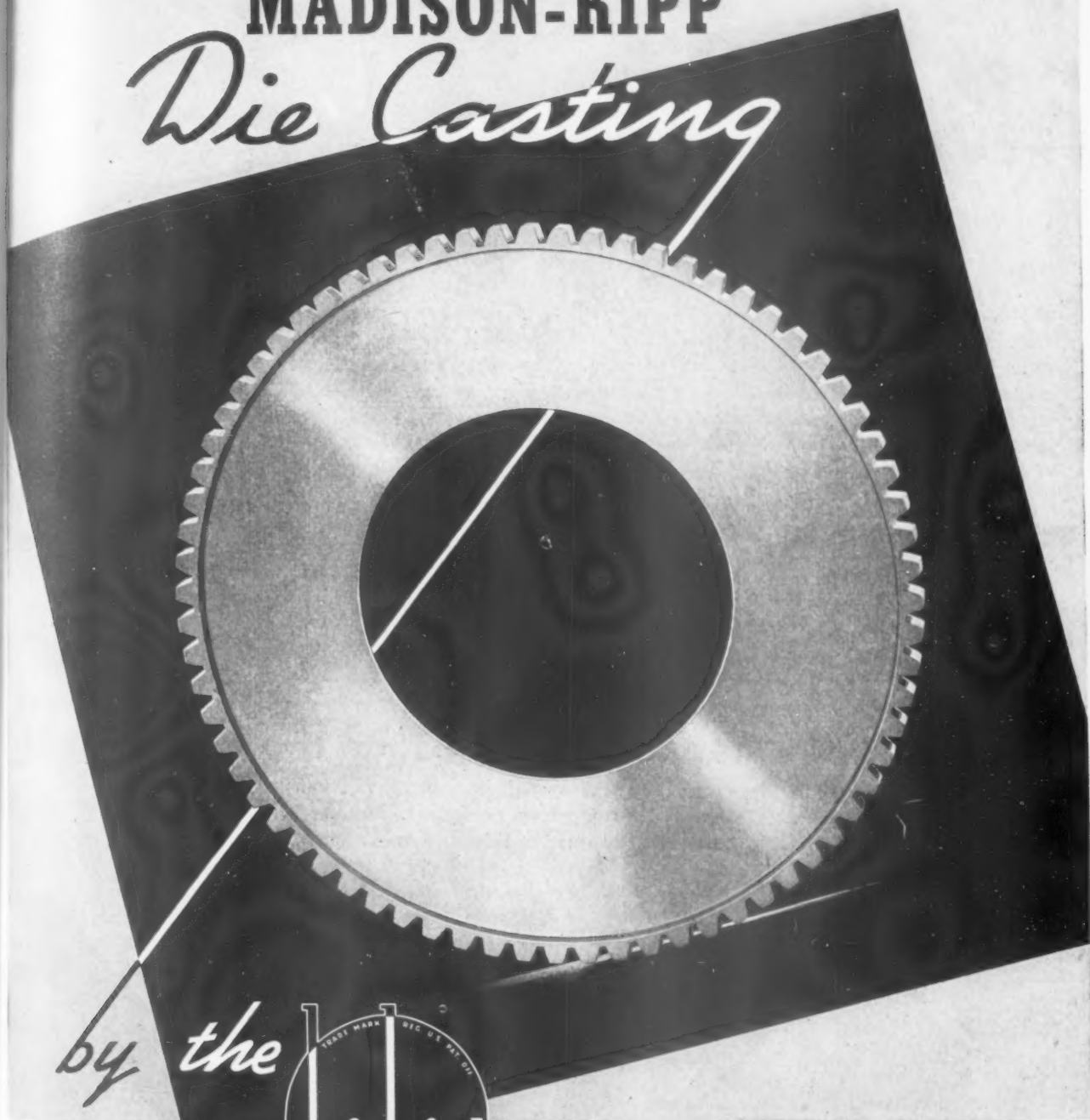
*Price  
Reduced*

Formerly \$15. Now \$12. Saving made possible by our increased production to meet growing demand... Write for full information.

TUNGSTEN ALLOY MFG. CO.  
65 Colden St., Newark 4, N. J.

**TAMALOY**  
*Diamond* **HONES**

# MADISON-KIPP *Die Casting*



*by the*



## **pressure process**

**LIGHT, STRONG, ATTRACTIVE, DURABLE**

Before the patented hi-high pressure process was developed the above part was "not suitable for die casting"

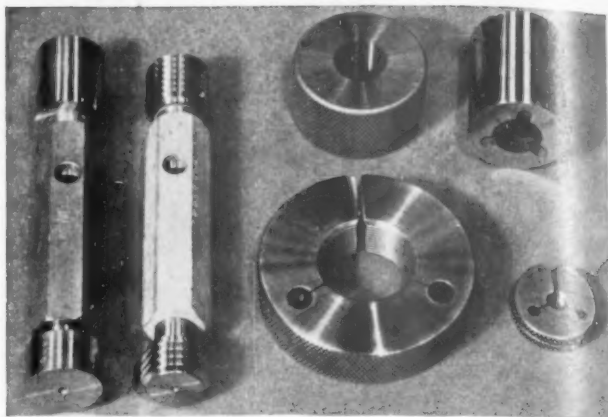
But die casting reached its present important position to the mechanical industries by challenge. Good mechanics with great determination have applied themselves to invent, pro-

duce, and promote one success after another. You may find that die casting will offer you a really great advantage in your present as well as your post war plans.

Madison-Kipp Corporation, 209 Waubesa St.  
Madison 4, Wisconsin. Sole Agent in England  
Wm. Coulthard & Co., Ltd., Carlisle.



# Prompt Shipment of **MERZ** PLUG AND RING GAGES...



● Merz standard, plain and threaded, plug and ring gages are manufactured under ideal conditions for extreme accuracy. They are made by skilled craftsmen, in a plant that was built and equipped for the exacting requirements of this industry. There are none better on the market, anywhere, and prices are competitive.

This company offers a complete engineering and tooling service. Standard gages are shipped promptly from stock; special gages and tools are designed and made to order; precision products and parts are manufactured on contract. Write for illustrated literature, "4 Spheres of Service To American Industry," just off the press.

# MERZ

*Engineering Company*  
INDIANAPOLIS 7, INDIANA

## First Came the Need—Then Came the OK Tool!

The O K System—the pioneer of inserted-blade metal cutting—was not just something someone "stumbled onto." Every element of modern O K construction grew gradually in answer to rapidly developing needs such as these:

*Longer edge life,  
Greater flexibility of cutting edge design,  
Better control of heat treatment,  
More scientific proportioning of stresses and strains,  
Economy in cutting steels.*

Working out these vital problems has placed the O K System in plants the length and breadth of the land . . . where they must justify their existence on a purely investment basis.



**MODERN TOOLS  
FOR MODERN  
METAL CUTTING**

THE



**SYSTEM**

OF INSERTED-BLADE METAL CUTTING TOOLS

THE O K TOOL CO., SHELTON, CONN.

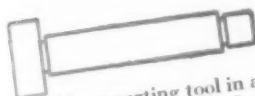
# Quick conversion

## from War to Peace with the Monarch Magnamatic

### Typical Magnamatic Jobs



Step shaft turned on a Magnamatic equipped with automatic feed changes for the three diameters of .025", .040" and .050" respectively. This feature saves valuable time on work like this.



On this job, two pieces are turned from each bar and separated by a parting tool in a separate operation. Total set-up time 8 minutes. Production, 45 complete pieces per hour.



Combination of chucking and step shaft turning on a Magnamatic equipped with air chuck and boring bar holder. Set-up to change from work between centers to that for automatic chucking takes only a few minutes.

Monarch Magnamatics will save many man-hours and machine-hours for war work, and then can quickly be converted to peacetime production without retooling.

Magnamatics are the most universal automatic lathes ever built. They will do a wide variety of turning, boring, facing or chucking work, with any number of diameters and lengths and with intervening contours or tapers. A reasonable number of tools in the rear carriage slide can be used for facing, necking, forming or chamfering. Single point tools are guided by gage blocks, micrometer heads or metal templates, depending upon the work.

Because the average set-up time is from 5 to 15 minutes, Magnamatics are economical for short runs. Yet, completely automatic operation enables fast, accurate production of large quantities at very low cost. On most jobs, one operator can tend two or more machines.

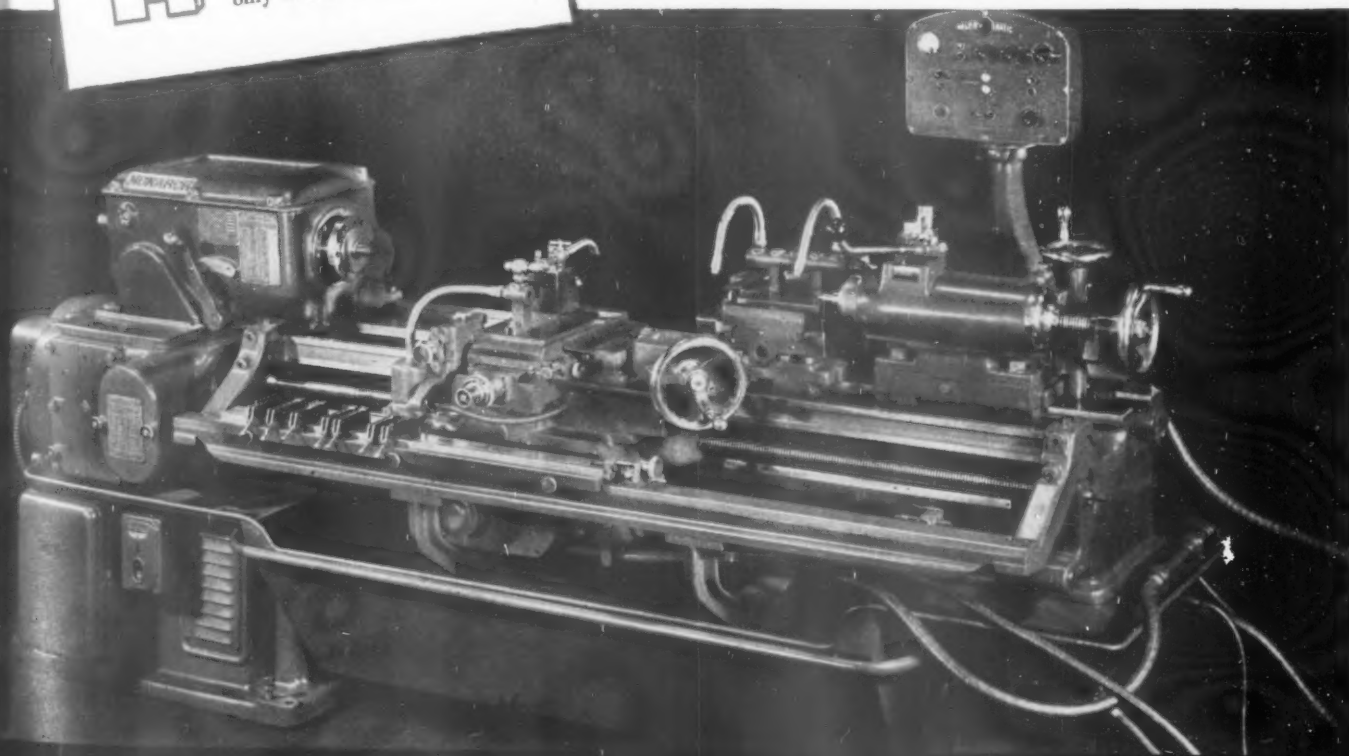
The value of Magnamatics was widely proved before the War, but production was stopped to meet greatly expanded demand for standard and toolmaker's lathes. Reasonably short deliveries can now be made. Our engineers will gladly help you utilize Magnamatics for present war work and later for peacetime products.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

Direct factory branches at Chicago • Cleveland • Detroit  
Newark • Pittsburgh • Representatives in principal cities.

## MONARCH LATHES

### Save Time



# Hanna

## *Air and Hydraulic*

# Cylinders



• The unusual tool shown above is a Bath Universal Rotary Stretching Machine equipped with special jaws. Built by Cyril Bath Co., of Cleveland, Ohio, it is used to stretch-form many types of work—an example is the tank strap illustrated on the machine.

A Hanna Hydraulic Cylinder is an important part of this Universal Rotary Stretcher—contributing to its smoothness of operation, power and control. Throughout industry there are thousands of other fine machines using the advantages of Hanna Cylinder Power to secure top efficiency and save time and labor. A Hanna Engineer will help you apply Hanna Cylinders to your advantage.

Write for Catalog 230 (Air Cylinders)  
and Catalog 233 (Hydraulic Cylinders)

**HANNA ENGINEERING WORKS**  
1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS  
RIVETERS • CYLINDERS • VALVES • AIR HOISTS



## STA-KOOL

### TOOL HOLDER

This new, patented diamond tool holder provides a fast, accurate method of meeting every requirement in dressing and truing operations. Equipped with internal coolant ducts for wet grinding, and external cooling fins for dry grinding, metal setting as well as stone are kept at safe operating temperatures, eliminating diamond breakage, due to overheating. Thus, tool life is increased, resulting in savings from 30 to 50% in diamond dressing and truing costs. For finish-dressing SMITITE Diamond Tools are available, in which the stones may be completely consumed without resetting.

Catalog on request.

**J. K. SMIT & SONS**  
157 Chambers St., New York 7, N.Y. 6400 Tireman Ave., Detroit 4, Mich.  
SUPER MATERIALS TOOLING



## ELLIPTOID TOOTH FORM

*Will be an IMPORTANT  
FEATURE of*  
**POSTWAR GEARS**



The ELLIPTOID (crowned) tooth form removes the greatest single cause of gear tooth failure—"end bearing." Although the crown or difference between end and center tooth thickness can be varied to suit each application, the recommended amount is .0003" to .0005" per inch of face. This is sufficient to prevent disastrous stresses at the most vulnerable point of the tooth—its end.

Gears with ELLIPTOID teeth withstand considerably heavier loads and have a much longer service life than gears with conventional teeth. Or, for the same torque load, gear weight can be materially reduced when the ELLIPTOID tooth form is used. Such economy will be a significant factor in meeting post-war competition.

Red Ring Gear Shaving Machines produce the ELLIPTOID tooth form without special cutters or additional machine time, and in addition, correct errors in index, helical angle, tooth profile, eccentricity and undersirable tooth roughness.

**WRITE**  
FOR DESCRIPTIVE BULLETIN



## NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

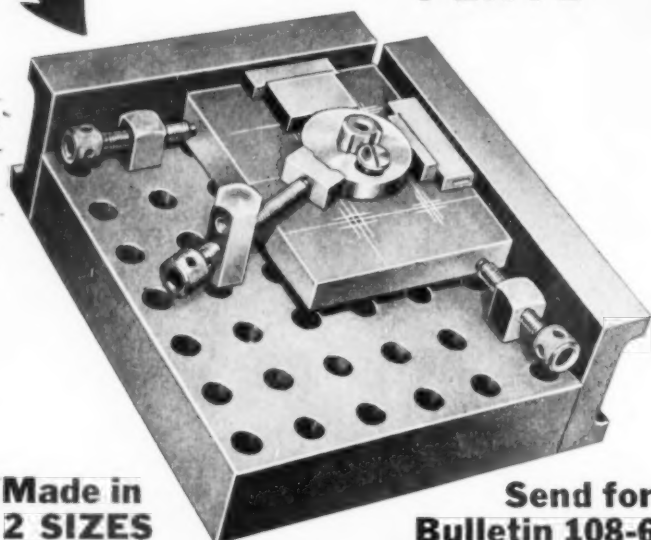
5600 ST. JEAN • DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL  
INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING  
AND ELLIPTOID TOOTH FORMS

# Eliminate COSTLY MACHINE TOOL Equipment

WITH THIS ANGLE PLATE "HOLOCATOR"



Made in  
2 SIZES

Send for  
Bulletin 108-6

**DAYTON ROGERS MFG. CO.** MINNEAPOLIS 7 MINNESOTA

2853 Twelfth Ave. So.

For accurate locating of all drilled and reamed holes and the laying out of dies and drill jigs, you can perform this task on any drill press very quickly with this tool-makers' device.

This precision device will take care of about 75% of the work that has to be performed on the average Jig Boring Machine.

This "Holocator" can also be used to advantage as a universal precision drilling and reaming jig, where accurate duplicated parts are required in small lots and where ordinarily a special jig would be required.

**AN All-Electric  
ADJUSTABLE-SPEED DRIVE  
FOR A-C. CIRCUITS**  
SPEED RANGES UP TO 16 TO 1  
-SIZES - 1 TO 30 hp-

**RELIANCE  
VOS  
DRIVE**



- 1 DIRECT DRIVE. Lower cost, because fewer parts (no intermediate speed-changing device). Power is closer to where it is needed. Use less space. Streamline your machine design.
- 2 SPEED CONTROL CONVENIENCE WITHOUT LIMITATIONS. Place speed-changer and start-stop button at any convenient point to which a wire can be run. Control always within easy reach.
- 3 OPERATES ON A-C. POWER.
- 4 QUICK STOPPING.
- 5 SMOOTH, FAST ACCELERATION.
- 6 REVERSING.
- 7 SPEED-SETTING.
- 8 SLOW FOR THREADING and INCHING.

Get Reliance Bulletin 311 for details - and other advantages.



**RELIANCE ELECTRIC & ENGINEERING CO.**  
1088 IVANHOE ROAD • CLEVELAND, OHIO  
Sales Offices in Principal Cities

## GET NEW BULLETINS on the *Zagar* Line of COLLET FIXTURES (HOLDING AND INDEXING)



- Holding and Indexing Fixtures
- Vertical-Horizontal Holding Fixtures
- Multiple Holding Fixtures
- Air-Operated Holding Fixtures

Also on -

- Zagar Collet Speed Chuck
- Zagar Broaching Machine

**ZAGAR TOOL, INCORPORATED**  
23881 Lakeland Boulevard • Cleveland 17, Ohio

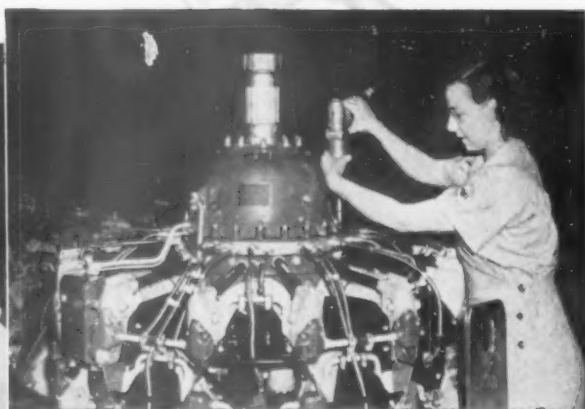
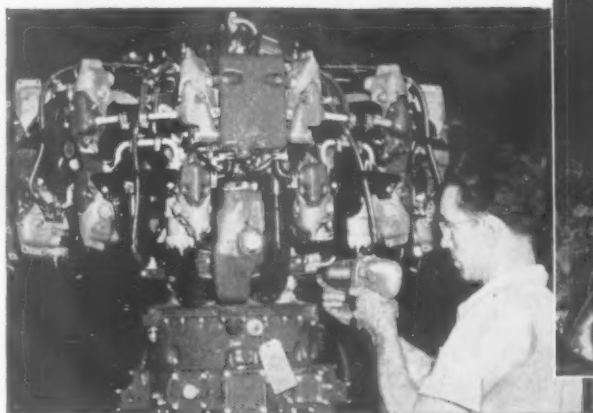


***Zagar* INDEXING  
AND HOLDING FIXTURES**



# FASTEST AND EASIEST

APPLY AND REMOVE NUTS  
THE *Impact* WAY



The Ingersoll-Rand air-operated Impact Wrench is one of the most useful portable power tools ever invented. A unique impact unit changes torque from the "Multi-Vane" air motor into fast "rotary impacts" that are transmitted to the nut. A few minutes observation of this machine on nut running will prove that it does the seemingly impossible—it delivers high torque to the nut without noticeable kickback to the hands of the operator.

There are five sizes—all smooth and speedy—all reversible—and they will apply or remove nuts from bolts up to 1 1/4 inches in diameter.

By using the Impact Wrench a saving in *man-hours* is realized—hours that can be used for other important operations that are so necessary during these critical times.

Other operations that can be improved by using Ingersoll-Rand Air Tools are: DRILLING, REAMING, TAPPING, CHIPPING, GRINDING, RIVETING, CALKING, HOISTING, etc.

## Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

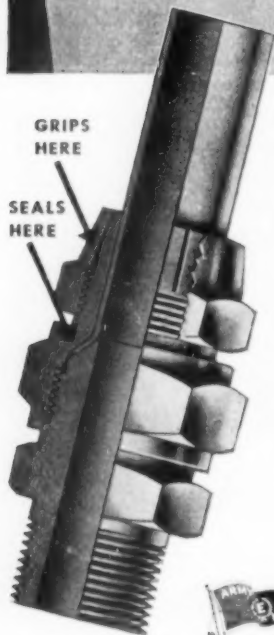
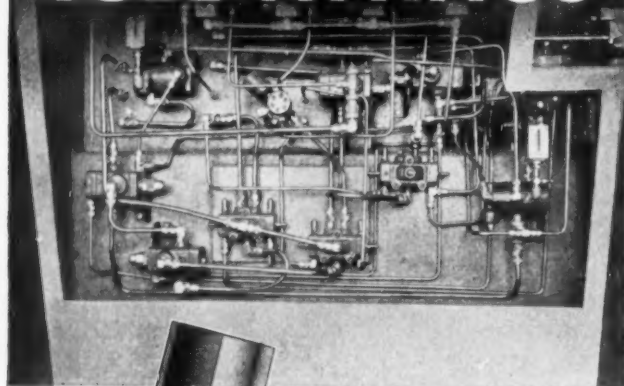
8-453

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES • CONDENSERS • CENTRIFUGAL PUMPS



# NO THREADING, WELDING OR SOLDERING WITH

## **COLLET GRIP** Seals as it grips **TUBE FITTINGS**



### A SAFE, DEPENDABLE AND EASILY INSTALLED FITTING

The ease with which COLLET GRIP Tube Fittings can be installed results in a big saving of time and service costs. To assemble or disassemble it is only necessary to tighten or loosen the compression nut, thereby permitting the collet nut to turn freely on the tube. This simplicity of design permits quick, easy installation of short lengths of tubing in close quarters—without bending the tube. COLLET GRIP fittings seal as they grip, providing connections as strong as the tubing itself—without threading, welding or soldering.



**LOGANSPORT MACHINE CO., INC.**  
Fittings Division  
902 Payson Road, Logansport, Ind.



Fittings shown here are Double Nut design; also made in Single Nut design, simplified for close work. Each design in 5 standard shapes.

**SEND TODAY FOR  
CATALOG No. 43**

Contains complete data on all standard fittings for tube sizes ranging from 1/4" to 2"

# ZING! ZIP!

**AND THE METAL IS CUT!**



### It's as easy as that when you cut with this new DeWalt High-Speed Metal Cutting Machine

This new, high-speed DeWalt will out-perform the ordinary types of "light metal" cutting machines you have heretofore been able to buy to do comparable work. It cuts metal fast, accurately, and with greater safety. *And it's built to last.*

One manufacturer, who has a battery of these high-speed DeWalts, is cutting S. A. E. 52100 solid bearing steel into 15 1/16" lengths—at the rate of 600 to 650 pieces per hour per machine, using women operators. The machines have already cut 4,500,000 pieces and are still going strong.

DeWalt engineering service helped this customer step up service. What is *your* metal cutting problem? We manufacture a complete line of metal cutting machines, and may be able to help you. Call in one of our engineers. Wire, write or phone DeWalt Products Corporation, 6103 Fountain Avenue, Lancaster, Pennsylvania.

**DE WALT**  
LANCASTER,

**RADIAL  
POWER SAWS  
PENNA.**

# FIRST BITE IN ANY FIGHT



SIEWEK-BUILT "PROGRESSIVE"

## ***SHEAR-CUT*** **END MILLS**

End mills must bite metal, before metal can fight.

Busy converting metals into American armament, Progressive Shear-Cut End Mills are cutting cleaner, faster and longer on the toughest jobs! Precision made of the finest materials, these end mills feed accurately, minimize chatter, give uniform cutting action and adequate chip clearance... permit working to extremely close limits.

Now manufactured by Siewek Tool Division of Domestic Industries, Inc. . . . Progressive "Shear-Cut" End Mills are the same high character product—with the extra resources and service of Domestic Industries, Inc.

When you need end mills, specify "Shear-Cut." They'll serve you long and well in starting your armament on the road to victory . . . as they have for so many others.

**SIEWEK TOOL DIVISION**  
**OF DOMESTIC INDUSTRIES, INC.**  
DETROIT (Ferndale Station) MICHIGAN



*Distributors in Principal Cities*

AFFILIATED WITH SIEWEK ENGINEERING DIVISION—CHICAGO • DETROIT • HARTFORD, CONN. AND SPRINGFIELD, MASS.—DESIGNERS AND BUILDERS OF TOOLS, DIES, JIGS, FIXTURES AND SPECIAL MACHINES

JULY, 1944

# HOW TO GET THE MOST PRACTICAL SOLUTION TO YOUR MILLING PRODUCTION REQUIREMENTS...

Whatever Your Milling Problem is, Sundstrand Engineers can Solve it Effectively... Using the Most Simple and Economical of these

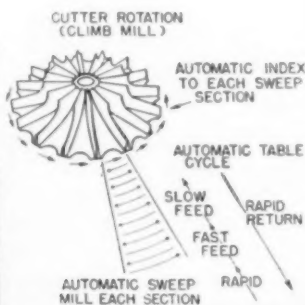
## 1 Standard Rigidmils with Fixtures and Tooling to Suit Your Work

### Sweep Milling Between Impeller Vanes

**Part**—Supercharger impeller.

**Operation**—Sweep milling surfaces between vanes, and indexing from section to section.

**Machine**—Sundstrand Model 33 Standard Fluid-Screw Rigidmil provides complete automatic cycle for a highly complicated milling operation as follows:  
(1) Automatic cycle is standard machine feature. (2) Automatic Index is provided by a standard attachment. (3) Automatic sweep cycle is built into the special fixture.



## three methods...

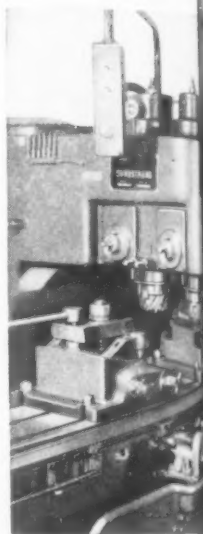
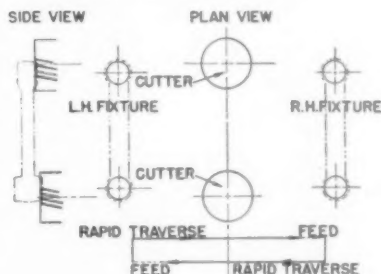
## 2 Standard Rigidmils with Special Heads and Tooling

### Face Milling Two Separated Surfaces

**Part**—Connecting rod.

**Operation**—Mill two surfaces simultaneously.

**Machine**—Sundstrand Model 33 Standard Fluid-Screw Rigidmil equipped with a special 2-spindle vertical head mills both faces. Standard two-way table cycle and two fixtures eliminate loading time.



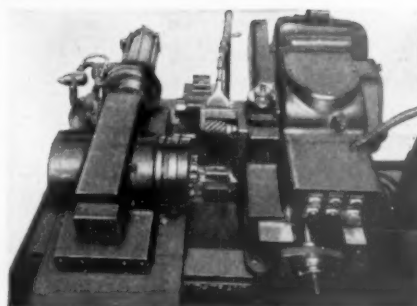
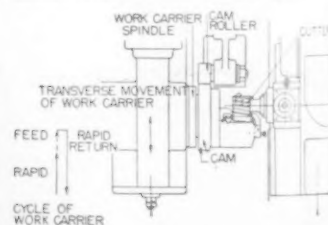
## 3 Entirely Special Milling Machines to Suit Specific Jobs

### "Turn-over Mill" for Turbine Blades

**Part**—Stainless steel turbine blade.

**Operation**—Milling curved surface on back of blades.

**Machine**—Special Sundstrand Hydraulic Rigidmil has adjustable milling head and opposing work-holding spindle mounted on two sets of ways. Fixture feeds to correct depth, then revolves through approximately 265° to mill curved surface on back of blade part.



### GET THESE Free BOOKLETS OR CALL IN A SUNDSTRAND PRODUCTION ENGINEER

These free booklets cover the entire range of standard Sundstrand Milling Machines. Write for them today—ask for Bulletins 826.



# SUNDSTRAND MACHINE TOOL CO.

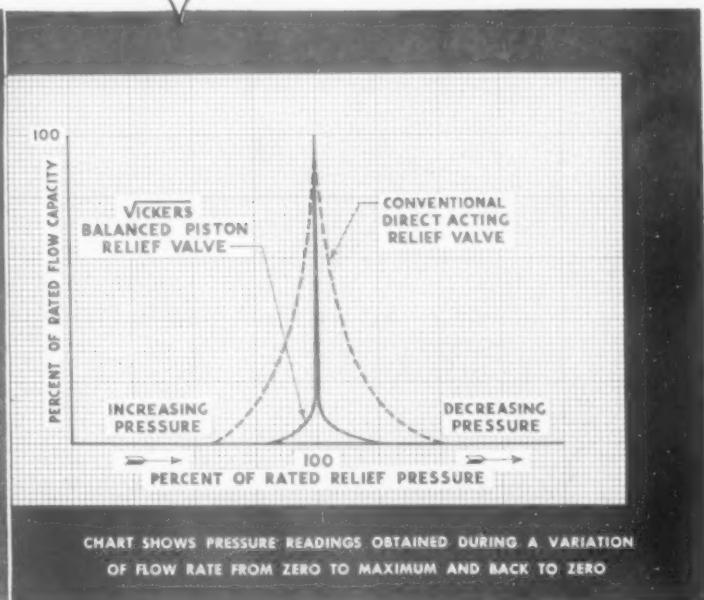
Rigidmils • Fluid-Screw Rigidmils • Automatic Lathes • Hydraulic Equipment • Drilling and Centering Machines • Special Milling and Turning Machines

2532 ELEVENTH ST., ROCKFORD, ILLINOIS, U. S. A.



# MORE ACCURATE

## HYDRAULIC PRESSURE CONTROL



# VICKERS

## Balanced Piston Type

# RELIEF VALVES

As indicated by the chart above, Vickers Balanced Piston Type Relief Valves have a negligible pressure variation throughout their capacity range. In these valves a hydraulically loaded and balanced piston takes the place of the customary spring-loaded direct-acting relief mechanism. This means more sensitive operation as well as greater accuracy throughout the wide pressure range.

This accuracy of control prevents pressure override when sudden changes in pressure occur in the hydraulic system. Compact design, longer operating life, installation directly in the pressure line, quiet operation, and simple adjustment are other advantages of these Vickers Balanced Piston Relief Valves. See Bulletin 38-3 for complete information.

Vickers Application Engineers will gladly discuss with you how Vickers Hydromotive Controls can be used to your advantage.

**VICKERS** Incorporated

1416 OAKMAN BLVD.

• DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES  
NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units  
for Every Hydraulic Power and Control Function





**STURTEVANT**  
**QUALITY**

## Easy to Read Accurately from *any* Working Angle

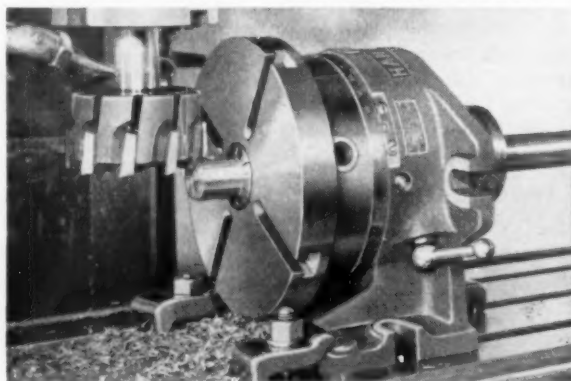
STURTEVANT TORQUE WRENCHES are not only accurate when new, but retain this accuracy *permanently*. However, much of this inherent accuracy would be useless were it not that the dials on STURTEVANT Wrenches are so designed that they assure accurate readings at all times and from all working angles.

Dials on STURTEVANT Wrenches do not have glass faces to glare, reflect, refract, crack, check, stain or break. The indicator pointer holds its fixed position—the clearly marked calibrations passing *laterally* below it. The tip of the indicator pointer just clears each raised or sharply depressed mark (you cannot cross-read below it). It is flared perpendicularly to screen out, adjacent calibrations and prevent mis-readings from side angles. Like the measuring element of STURTEVANT Wrenches, these improved dials are permanently accurate, they require no periodic re-settings.

Write for Bulletin TW-28 Showing STURTEVANT Torque Wrenches in capacities from 0-40 inch ounces to 7200 inch pounds.

P.A. **STURTEVANT CO.**  
ADDISON **QUALITY** ILLINOIS

## SOLVE YOUR PROBLEMS WITH THE SUPER-SPACER



The Hartford Super-Spacer is a valuable asset in the tool room for simplifying many puzzling machining problems. It is easily set up for a large number of milling operations. An even greater variety of jobs can be done when it is equipped with a face-plate and draw-in collet combination. The illustration above shows the adaptability of such a combination for milling bar stock on a vertical miller. As a basis for special fixtures, the Hartford Super-Spacer provides a substantial and accurate indexing foundation.

WRITE FOR COMPLETE INFORMATION

**THE HARTFORD SPECIAL MACHINERY CO.**  
HARTFORD, CONN.

**YOU CAN DO IT—**  
*Faster..Better*

With  
**BOYAR - SCHULTZ**  
No. 2

## Profile Grinder

FOR fast, accurate, economical grinding of irregular profiles, odd and difficult shapes encountered in tool and die, experimental and development work.

Both independently powered spindles operate at 10,000 R.P.M., affording rapid stock removal, even with small diameter wheels. Vertical oscillations reduce wheel wear.

Saves time on many operations that would otherwise require hand work or costly "set-up" time on machines of other types. Made in two models—Dual Spindle as shown or with single spindle. Many users have discovered the value of this machine tool in production as well as in tool and die work.

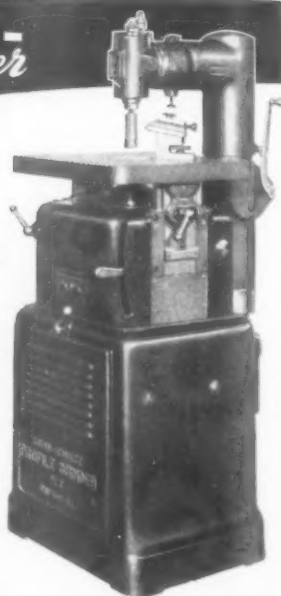
Circular Gives Complete Description—Write

**BOYAR - SCHULTZ CORPORATION**

2116 Walnut St.

CHICAGO 12, ILL.

THE TOOL ENGINEER





**...and remember that CHUCKS are TOOLS**

If you break a mirror, that is considered bad luck. But the actual loss is only a piece of glass and it can be replaced. When a critically needed cutting tool or an equally essential chuck is ruined, the loss is not limited to a single unit, hard as it may be even to replace that unit. You also lose the continuing stream of urgently needed war materiel that tool or chuck could have produced, had it been kept on the job.

All of us have a job to do in seeing to it that tool-power as well as man-power is carefully conserved and efficiently

maintained for maximum output with minimum waste. We are more anxious to help you keep present Cushman Chucks on the job, producing to capacity, than we are to supply you with new ones. We urge you to call every operator's attention to the simple rules of good chuck maintenance that will prolong service life and retain initial high accuracy. These rules have been briefed on small "Chuck Check" cards which we will be glad to supply upon request for distribution in your plant. Also feel free to consult our engineering department freely on any special problems that may come up. The Cushman Chuck Company Hartford, Conn.

# CUSHMAN

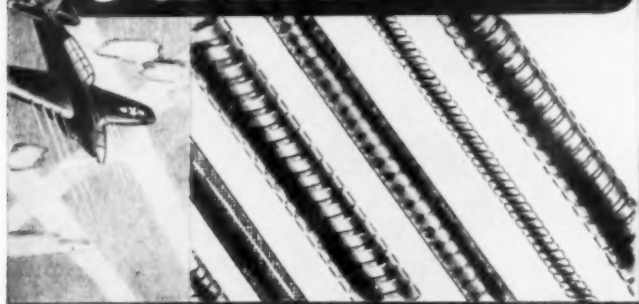
**A World Standard for PRECISION**

Send for these "Chuck Check" maintenance cards today.





# WAR'S TESTS POINT THE WAY FOR POST-WAR REDESIGN WITH **WALKER-TURNER** *Flexible SHAFTING!*



Walker-Turner Flexible Shafting has thoroughly demonstrated its dependability in aircraft and other mechanical weapons—where requirements are especially severe. When the war emergency arose, this shafting was ready, having been used for many years in Walker-Turner Flexible Shaft Machines and in industrial machinery produced by other manufacturers. Today, in the redesign of mechanical products for post-war use, engineers are turning more and more to Walker-Turner Flexible Shafting as a solution to problems in light power transmission and remote control. Can we help you?

**WALKER-TURNER COMPANY, INC.**  
Berckman Street • Plainfield, N. J.

**walker-turner**  
COMPANY, INC.  
PLAINFIELD, N. J.

## FLEXIBLE SHAFTING

FOR REMOTE CONTROL AND POWER TRANSMISSION

# Rawhide

The best "soft" hammers and mallets are rawhide — tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

Write for Catalog Sheets.



Universal Drill Bushings save valuable tool drills.

Because they are straight and round and have

super-finished bores, Universal

Drill Bushings in-

sure accuracy

and possess

unex-

celled wear-

ing qualities.

Tough, precision-

made. Write today for

further facts about Universal Drill Bushings,

Collet Chucks and Floating Chucks.



**UNIVERSAL ENGINEERING CO.**  
FRANKENMUTH, MICHIGAN

# WHAT TO LOOK FOR WHEN YOU BUY GAGE BLOCKS

## 1. DIMENSIONAL ACCURACY:

Gage blocks must have their surfaces flat—parallel and all dimensions accurate as indicated. Rigid inspection of every Webber Gage block insures its dimensional accuracy.

## 3. SURFACE FINISH:

Fine finish is necessary to provide maximum accuracy—reduce wear and improve wringing. Webber Gage Blocks are given the finest finish commercially possible to put on steel.

## 2. STABILITY:

The steel in gage blocks must be stable—not change size. After long years of research—Webber has developed a steel and method of treatment which guarantees against changing size for any reason except normal wear.

## 4. WEARING QUALITY:

Gage blocks must be able to stand up under normal usage without showing excessive wear. Performance records prove that Webber Gage Blocks have exceptional "wearing quality."

*and SERVICE after the sale!*

Webber Gage Blocks not only assure dependable precision measurements on the various steps of production from tool room to assembly but Webber service provides complete facilities for the inspection—reconditioning—and replacing of worn or damaged blocks at a moderate cost. Webber service also includes a selection of the following sets—

Set No. 84A—\$350.00

Set No. 84B—\$235.00

Set No. 43A—\$185.00

Set No. 43B—\$150.00

Set No. 38A—(Thin Blocks) \$195.00

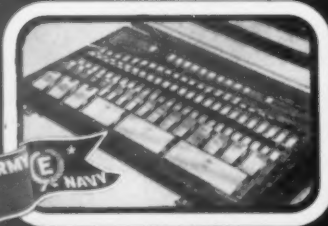
Set No. 38B—(Thin Blocks) \$155.00

Set No. 14A—(Angle Blocks) \$450.00



# Webber GAGE COMPANY

12908 TRISKETT RD. • CLEVELAND 11, OHIO



# Counteract BACK and SIDE WEAR

with improved  
**MILFORD  
PROFILE  
SAW...**

It is a fact that most contour and profile saws fail on the back and the sides before the hardened cutting edge wears. Not so, MILFORD PROFILE SAW!

This is but one of the many accomplishments of MILFORD metallurgy.

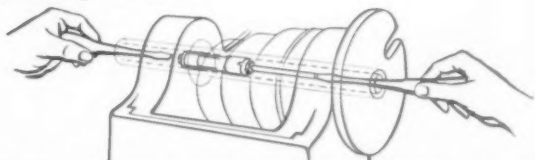
SERVICE? One of the large manufacturers of airplanes needed some PROFILE SAW in a hurry. They telephoned us . . . "Could we ship 8 miles of PROFILE SAW at once?" That was only a little over 42,000 feet, and we shipped it from stock that very day. True, we couldn't duplicate that every day, but our stocks are large and complete, and shipments are prompt.

**THE HENRY G. THOMPSON & SON CO.**  
Saw Specialists Exclusively for Over 65 Years  
NEW HAVEN, CONNECTICUT, U. S. A.

## ONE JOB PAYS FOR THIS NEW SPINDLE STOP



Here's a quick set-up for positioning repeat operations in your lathe. Tighten the Rieger Spindle Stop in the hole of the headstock spindle with two screwdrivers. You automatically limit entrance of work pieces . . . save measuring each piece in a run . . . assure accuracy. In short, the Rieger Spindle Stop enables you to put your lathe on a production basis for repeat operations. Regular model fits  $\frac{3}{4}$ " holes. Won't scar or burr walls. Ready for immediate delivery. Ask for complete information. Write now while you're thinking about it.



Tightens with two ordinary screwdrivers. Expanding collet action. Won't mar spindle. Model SS-75 fits  $\frac{3}{4}$ " holes — Atlas, Clausing, Craftsman, Logan, 9" South Bend lathes, and others.

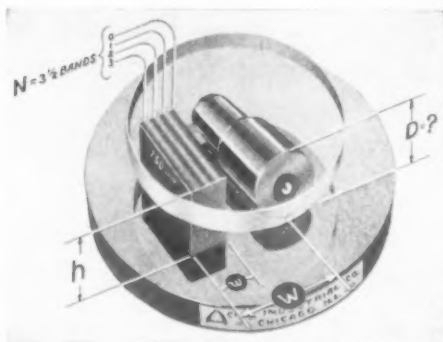
**THE RIEGER MANUFACTURING CO.**

Dept. TE-7

MIAMISBURG, OHIO

## MEASURING A PLUG GAGE with LIGHT WAVES

using an optical flat, a toolmakers flat and a gage block



The formula is:

$$D = h + (.000012 \times N \times \frac{W}{\lambda})$$

Substitute the actual values

$$D = .750 + (.000012 \times 3\frac{1}{2} \times \frac{1.7/16''}{23/64''})$$

and get the answer

$$D = .750168 \text{ inch.}$$

**It's just that simple!**

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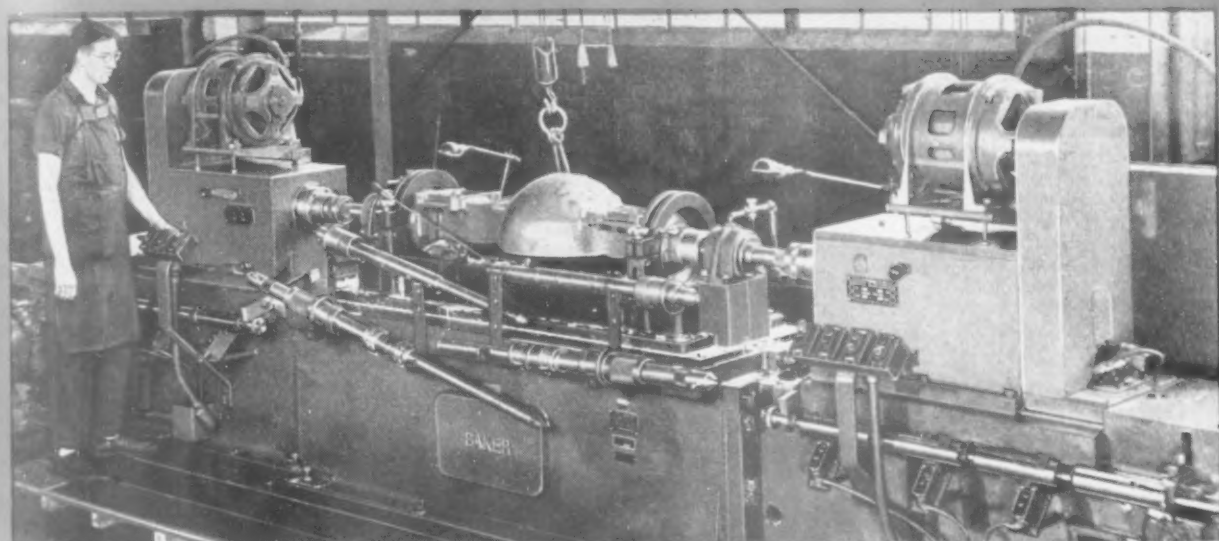


**ACME INDUSTRIAL CO.**

Makers of Standardized Jig and Fixture Bushings  
208 N. Laflin St. MONroe 4122 Chicago 7, Ill.



# TEAM WORK BY BAKER AND MACK!



THIS BAKER 30-HH 2-way, horizontal, opposed type, hydraulic feed machine demonstrates one of many jobs in which Baker machine tools are aiding the Mack Truck Company, Allentown, Pa., to build heavy, serviceable, prime mover trucks. The machine performs rough boring, second boring, and finish boring of axle tube bores on the steel rear axle housing. Three boring operations, ranging up to 3.995" diameter are performed on each end of the housing.

● Each opposed single-spindle head has a maximum of 52" travel so that it can be returned to the rear of the fixture automatically to allow quick changes of tooling. Each head is arranged with a direct v-belt motor drive with three quick speed changes to

provide correct speed for each operation. Another important feature is the quick-change cycle attachment which provides correct cycling for each operation. Convenient push button stations control all operations.

● Mack engineers designed the fixture used on the machine. Boring bars are amply supported on the outside of the housing, and also are supported in the center in the banjo opening. The center bed carries the work-holding fixture, with two Baker long-travel hydraulic feed units mounted on either side to provide flexibility. Baker self-contained floor type units are doing their part in the war effort, and are designed for ready conversion to peacetime operations.

## Baker Brothers, Inc.

Toledo 10, Ohio

MACHINES FOR DRILLING • BORING • TAPPING • CONTOUR GRINDING

# NEW EQUIPMENT

## • Materials + Processing •

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY



**Four-Way Universal Machine for Hollow Milling and Facing**

### LE MAIRE DEVELOPS FOUR-WAY MACHINE

(P8)

LeMaire Tool & Mfg. Co. has developed a new four-way universal machine for hollow milling and facing universal joint spiders. The same type machine can be arranged for boring, drilling, reaming, and similar operations. In many cases threading operations also can be done in the same set-up.

The machine is composed of four standard end bases, each supporting a LeMaire Twin Ram Hydraulic Unit, bolted to a special center base. Four spindles operating at 90° apart are arranged with infinite speeds to machine various diameters. Galling and possible chip trouble are avoided by ball-bearing mounted sleeves, which remain stationary while the spindles revolve.

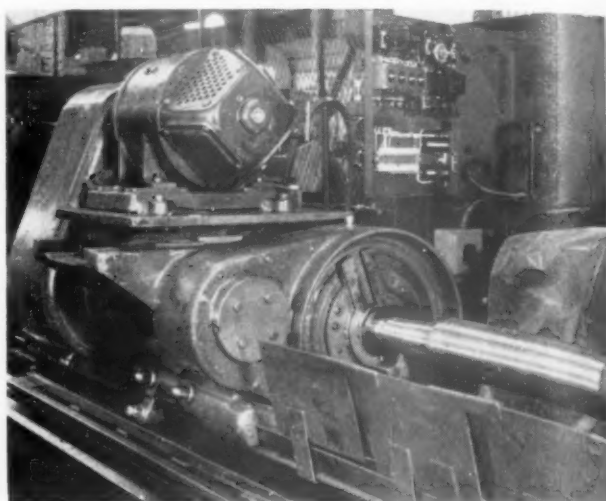
### COLD DRAWING MACHINE (P9) RATED AT 7½ TONS

John S. Barnes, Inc. announces development of a hydraulic cold drawing machine with 7½-ton capacity.

In operation, the work piece is supported by a drawing die mounted centrally on the working table. When the machine is started by means of two push buttons, a small cylinder ram traverses from the left and stops behind the die. Then the large ram moves forward forcing the work through the die, with the drawn piece steadied by the small ram upon leaving the die. The ram is returned to starting position by pressing two push buttons. The dual push-button control system, requires the use of both hands of the operator, thus eliminating all danger.

Variable traverse rates up to 240" per minute are possible and a dial pressure gage clearly indicates the die loading throughout the drawing cycle.

Also announced by the company is



**New Reliance Electric Adjustable-Speed Drive**

### INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

the development of a hydraulically actuated horizontal forming press with five-ton capacity.

Features cited for this press by the manufacturer are safety dual push-button control, ram traverse of 45" per minute forward and 90" per minute return, maximum pressure of 800 psi, and a convenient waist-high working table free of unnecessary obstructions.

### ELECTRONIC SPEED CONTROL (P10) ANNOUNCED BY RELIANCE

The Reliance Electric & Engineering Co. announces it has developed an electronic system of adjustable-speed

drives designed to provide speed ranges from 20 to 1 or better and to operate from a regular polyphase a-c distribution system, 220, 440, or 550 volt, two or three phase, 25, 50, or 60 cycle.

The manufacturer states that a substantially wider range of operating speeds can be obtained where the actual motor load is light, such as in machine-tool feed applications. The drive is available in 1, 1½, 2, 3, and 5 hp sizes. Additional advantages claimed for the unit are that it is possible to obtain controlled torque for starting, braking and stopping, and to control starting, stopping, and reversing operations from one or more points about the driven machine.

The unit consists of a small cabinet housing the necessary tubes and transformers, a motor connected to the load, and a "start-stop-and-reverse"

(Continued on page 166)



**Barnes Hydraulic Cold Drawing Machine With Dual Safety Controls**

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Request the information and service you desire and keep your library up-to-date...

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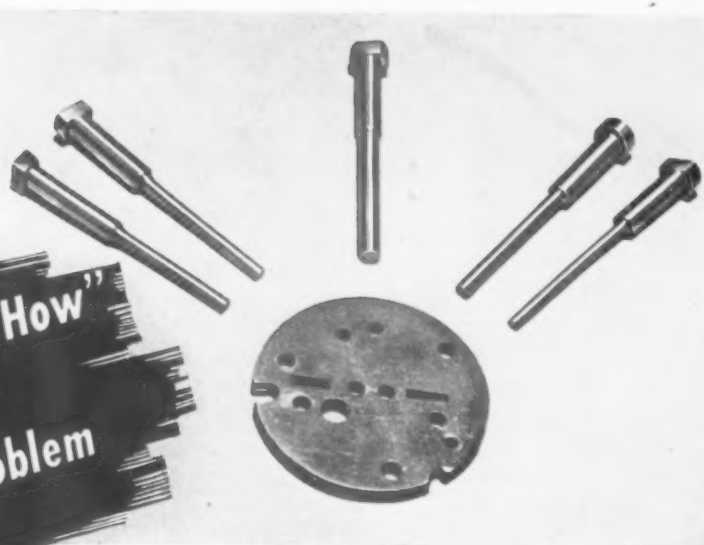
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**3**  
**ANSWERING  
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TO CALL**



## How Heat Treating "Know How" Helped to Lick a Tough Hardening Problem

Here is an on-the-job story of how Carpenter tool steel and the practical knowledge of a Carpenter representative teamed up to solve a tough tool steel problem. The facts are summarized below. The tools and work involved are shown in the photograph.

### THE JOB:

Punching  $\frac{3}{4}$  hard brass (Rockwell B-79), .137" and .150" thick, in a double acting 250-ton punch press. The holes to be punched vary from .099" to .167".

### PROBLEM:

Preventing cracking of punches under the head during hardening, avoiding decarburization and keeping the punches straight in quenching. About 75% of the punches hardened had been cracking in the shoulder under the head in the hardening process.

### SOLUTION:

The Carpenter representative, when asked for advice, made the following suggestions: First, to use the

recommended furnace atmosphere of 2% to 4% oxygen. Second, to switch from a tap water quench to one of 10% brine. Third, to heat the punches in a piece of  $\frac{3}{4}$ " round iron pipe (both ends open)—so that the punches can be dropped vertically into the brine to get a full quench under the head.

### RESULT:

On the first try following these recommendations, some 200 punches made from Carpenter Green Label Drill Rod were hardened, using a temperature of 1450° F. with an atmosphere of 2% to 4% Oxygen. The problem was licked! Decarburization was eliminated and all were O.K. for straightness. In production they averaged 100,000 holes per punch.

- If you have a tool steel problem—or if you should like help in getting tools that give longer uninterrupted production runs—your nearby Carpenter representative will be glad to give you every assistance. He can supply you with helpful printed matter—he can render personal "on the spot" service—and he will keep you in touch with the Carpenter Metallurgical Department.

THE CARPENTER STEEL COMPANY  
122 W. Bern St., Reading, Pennsylvania



**Carpenter**  
**MATCHED**  
**TOOL STEELS**

push-button station in which the speed-changing rheostat has also been incorporated. The transformer which steps down the voltage of the a-c supply for the anode circuit of the rectifier tubes is mounted individually in the base of the cabinet.

**TURNING LATHE FORMS (P11)  
INTRICATE SHAPES**

Capable of extremely intricate shaping and forming work, a new shape-turning lathe that makes possible turning, boring, and facing in almost any desired shape, has been introduced by the Monarch Machine Tool Co.

The manufacturer states that oval-shaped bottle molds, dies for glass or plastic dishes, and punches or spinning chucks for silverware and hollow ware of all types can be machined with ease on the lathe. In addition, original molds can be duplicated exactly, as often as needed to put the product involved on a mass-production basis.

Repetition of the shape to be cut is determined by the geared relationship of cam and spindle revolutions. According to the company, the two chief difficulties of shape turning—smooth blending of surfaces, such as the change of sections from round to oval or hexagon to square, and the problem of producing sharp, clean-cut corners in recessed or exterior angles have been overcome.

Mechanism of the lathe consists of three elements. One controls the shape cut, another regulates the rate of repetition of the shape on any given circumference, and the third controls the contour generated on successive diameters.

**GEAR SHAVER INCORPORATES (P12)  
CROSSED AXES PRINCIPLE**

National Broach & Machine Co. announces a new gear tooth shaving machine for finishing of both internal and external gears from 12" to 36" P. D.

The machine incorporates the rotary crossed axes principle with the work carried horizontally on a power-driven rotary work table. The machine has been designed with no obstructions directly over the work table to facilitate

loading and unloading. A power hoist to aid in loading the heavy or bulky work is furnished as optional equipment.

In operation, the teeth of the work gear mesh with those of the cutter which is free to rotate and which is driven by the work gear, at the same time being slowly reciprocated across the face of the work gear in a direction parallel to its axis. Final work gear tooth size is controlled by the total amount of in-feed over the entire cycle.

Other features are precision anti-friction bearings on the cutter spindle, central push-button and selector-switch control station located within easy reach of the operator, automatic lubricating system, and control panel and coolant pump mounted in the base.

**INFORMATION FREE**

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**FIVE-SPINDLE GRINDER (P13)  
HAS AUTOMATIC SIZER**

Designed especially for high-speed, high-capacity production, a new five-spindle surface grinder, designated as the No. 100, has been introduced by Hanchett Mfg. Co.

Each of the five grinding wheel heads carries a 40 hp, 900 rpm motor, is fitted with an automatic sizing device which automatically compensates for wheel wear and operates in increments of .0002".

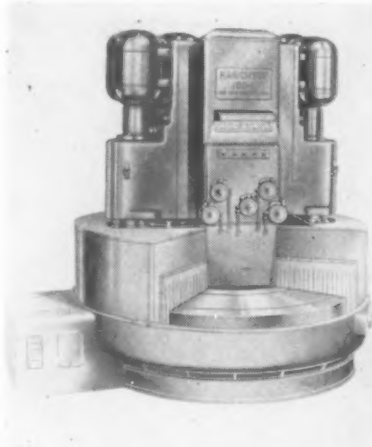
Three of the grinding wheels are usually coarse grained for stock removal, the fourth is medium-fine grain, and the fifth, or finishing, wheel is of a fairly fine grain. Variations in grain numbers can be made to fit the job. The T-slotted work table 100 inches in diameter by 20 inches in width, is driven through a variable speed unit by 5 hp 1200 rpm motor. The grinder is equipped with a wheel dresser for each wheel head, and each head is provided with a built-in ammeter so that action of the grinding wheels can be observed easily.

**PLASTIC MOLDING MACHINE (P14)  
HOLDS INSERTS IN PLACE**

Lester Engineering Co. announces a new vertical injection molding machine

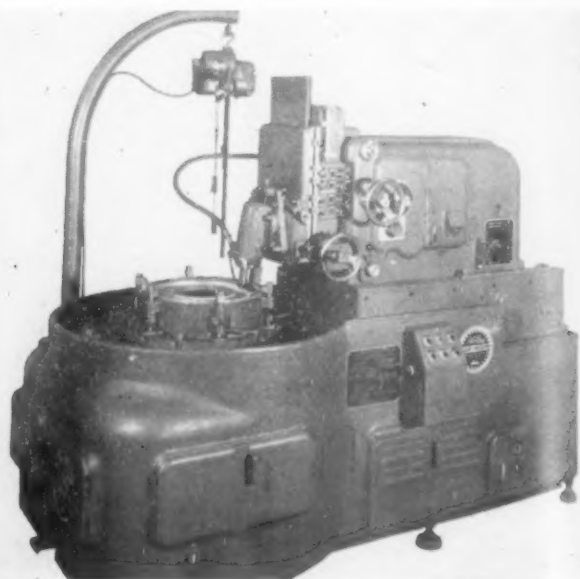
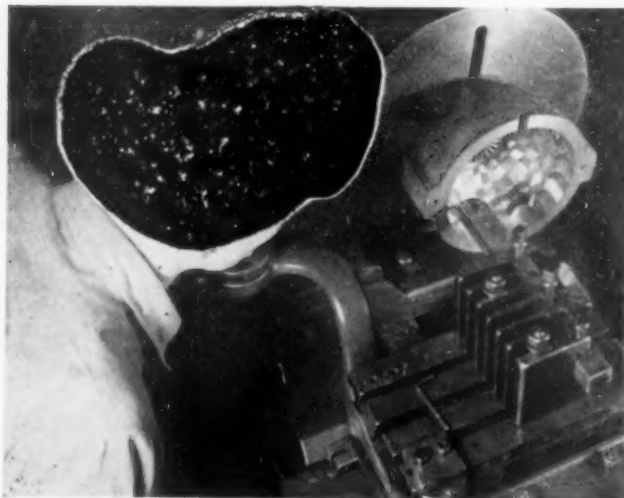


(Continued on page 168)  
Above: Injection Molding Machine  
Below: Hanchett No. 100 Grinder



Right: New Gear Tooth Shaving Machine

Below: Monarch Lathe For Shaping and Forming





**DEPENDABLE** ...so are Morse Tools

That's why Morse Tools are standard in so many plants

**TOOLS ARE WEAPONS - TREAT 'EM RIGHT!**

# MORSE

THERE IS A  
DIFFERENCE

**TWIST DRILL AND  
MACHINE COMPANY**

NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

SAN FRANCISCO STORE: 1180 FOLSOM ST.

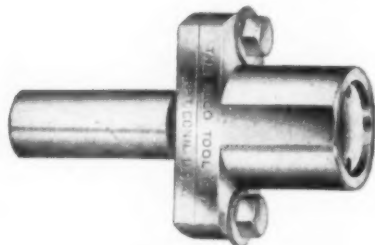
for plastics, designed to facilitate the production of castings having inserts which must remain fixed in position.

The machine may be used for injection molding of thermoplastic material, injection molding by the jet process of thermosetting materials and rubber compounds, and injection molding of electronically heated pre-forms in plastics or rubber.

Although vertical in design, the machine is equipped with horizontal die platens. Consequently, the tendency of castings to shake loose and fall out with possible injury to the die is eliminated, according to the manufacturer. It is also pointed out that vertical injection cylinders can be filled more completely and that wear and drag of horizontal cylinders are eliminated.

#### SCREW MACHINE TOOL (P15) HAS DUAL FUNCTION

Alco Tool Co. announce development of a new dual screw-machine tool



Alco Screw Machine Tool

#### INFORMATION FREE

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which serves as combination roller stop and support.

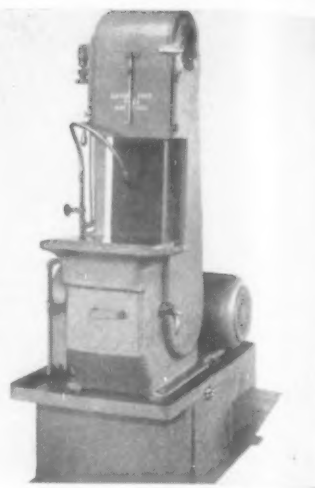
Used as a stop, the tool prevents abuse of the work ordinarily caused by roughness, imperfections, or chips which accumulate on a stationary stop, the company states. The disc in the stop revolves concentrically with the work with the concentric action quickly adjustable through a floating alignment feature.

For accurate forming requiring rigidity, or as a support for long work, an easily installed insert takes the place of the revolving disc. The insert revolves concentrically with the work and supports it rigidly at the free end. The tool is said to eliminate chatter marks caused by vibration, and to permit increased feeds on forming.

#### SURFACER DESIGNED FOR (P16) GREATER ACCURACY

Said by the manufacturer to incorporate increased coolant capacity and rigid construction for greater grinding accuracy, a new wet-belt surfacer has been introduced by the Porter-Cable Machine Co.

Inexperienced operators can achieve tolerances as close as .0005" on the machine, according to the manufac-



Wet-Belt Surfacers

turer. Other features include a 35-gallon self-contained recirculating pump system, a readily accessible waste and clean-out drawer, higher table for greater convenience to the operator, flexible tube to provide "spot" coolant where it is needed in greater quantity, and greater platen grinding area.

#### WORK HOLDER DESIGNED (P17) FOR PRECISION PARTS

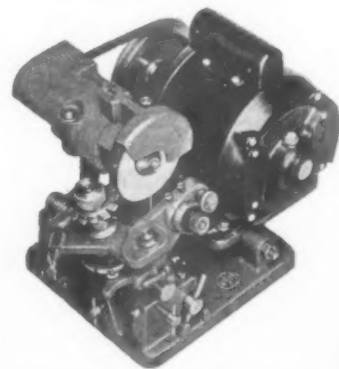
Developed to overcome difficulties encountered in drilling, counter-sinking, and tapping small precision parts (Continued on page 170)

The performance of your machines is directly related to cutter efficiency. The most economical cutter is one that's kept sharp.

The new Waltham Cutter Sharpener is designed to sharpen tools for gear cutting and thread milling, circular form tools, straight fluted hobs, and multiple cutters—and to do this quickly, accurately, and economically.

One, or more, of these sharpeners will soon pay for itself in the tool room or when used with your machines on the production line.

Maximum cutter capacity is 2" diameter and 3/8" thick—complete details will be found in the new folder No. 344. Mail the coupon for your free copy!



**DULL CUTTERS ARE EXPENSIVE CUTTERS—KEEP THEM SHARP ON THE**

## EDWARD BLAKE CO.

634 COMMONWEALTH AVENUE  
NEWTON CENTRE 59, MASS.

Please send folder No. 344 giving complete details on the Waltham Cutter Sharpener.

Name ..... Title .....

Company .....

Street .....

City ..... State .....

T.E.

# Waltham

## CUTTER SHARPENER

BLAKE TAP GRINDERS—L & O HIGH SPEED DRILL PRESSES—WALTHAM  
CUTTER SHARPENERS—AMERICAN TOOL HOLDERS—BLACK DIAMOND  
PRECISION DRILL GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS

# THE *Carbide* AGE

MEANS MORE PRODUCTS, BETTER PRODUCTS AT LESS COST!

It's the new age in metalworking . . . new production speeds attained daily . . . new metals, machines and methods boost quality and precision standards higher and higher! Production costs go down! Modern carbide cutting tools are making this progress possible. Consider for instance, this performance record — made by WESSON Carbide Cutting Tools.

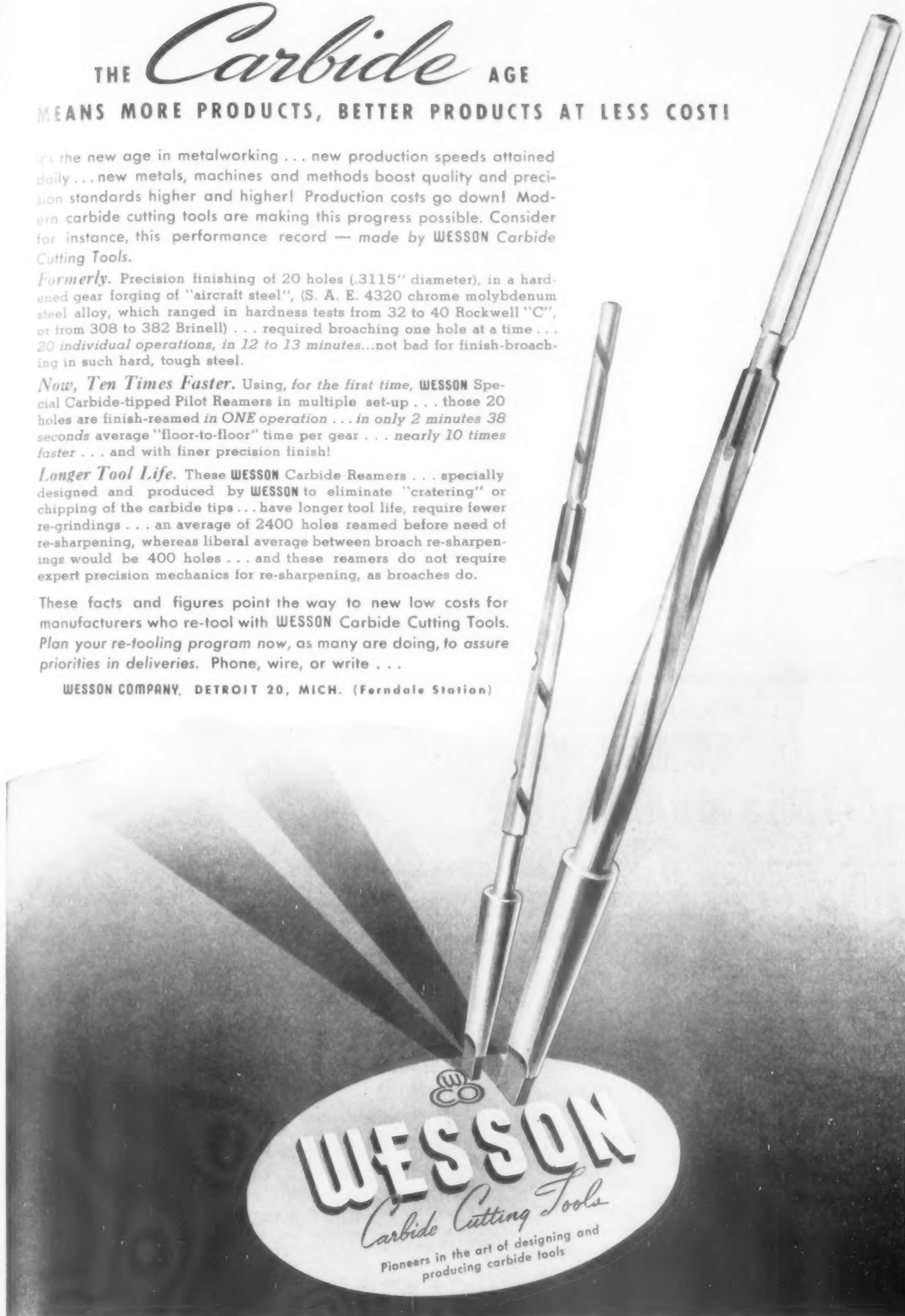
**Formerly.** Precision finishing of 20 holes (.3115" diameter), in a hardened gear forging of "aircraft steel", (S. A. E. 4320 chrome molybdenum steel alloy, which ranged in hardness tests from 32 to 40 Rockwell "C", or from 308 to 382 Brinell) . . . required broaching one hole at a time . . . 20 individual operations, in 12 to 13 minutes...not bad for finish-broaching in such hard, tough steel.

**Now, Ten Times Faster.** Using, for the first time, WESSON Special Carbide-tipped Pilot Reamers in multiple set-up . . . those 20 holes are finish-reamed in *ONE* operation . . . in only 2 minutes 38 seconds average "floor-to-floor" time per gear . . . nearly 10 times faster . . . and with finer precision finish!

**Longer Tool Life.** These WESSON Carbide Reamers . . . specially designed and produced by WESSON to eliminate "cratering" or chipping of the carbide tips . . . have longer tool life, require fewer re-grindings . . . an average of 2400 holes reamed before need of re-sharpening, whereas liberal average between broach re-sharpenings would be 400 holes . . . and these reamers do not require expert precision mechanics for re-sharpening, as broaches do.

These facts and figures point the way to new low costs for manufacturers who re-tool with WESSON Carbide Cutting Tools. Plan your re-tooling program now, as many are doing, to assure priorities in deliveries. Phone, wire, or write . . .

WESSON COMPANY, DETROIT 20, MICH. (Ferndale Station)







"Flat Top" Work Holder

which must be held accurately perpendicular, a new work holding fixture has been developed by Mead Specialties Co.

The work holder also is ideal for many operations on small shapers and bench milling machines, according to the manufacturer. The fixture holds any type of work which is flat on the

bottom, varying in thickness from a few thousandths up to two inches, and in area from the size of a dime up to several inches square. The peripheral contour of the work has no effect on the fixture.

#### EXPANSION REAMER LOCKS (P18) CUTTING BLADES

A new high-speed-steel expansion reamer which employs an adjusting lock-nut to hold the three cutting blade segments rigid and prevents any possibility of an oversize bore resulting even when the reamer blades are subjected to excessive pressures, is announced by Lempco Products, Inc.

Two of the blade segments spiral in



Lempco Expansion Reamer

an opposite direction to that of the third, simultaneously, to affect a shearing action which finish-reams mirror-smooth any machinable metal, ferrous or non-ferrous, as well as laminated phenol-formaldehyde and other fibrous plastics, ordinarily difficult to machine smoothly, the company states. Blades are quickly and easily removed for re-sharpening and maintain their edges longer than ordinary reamers because expansion from .035" to .080" is provided, the company adds.

#### SIZE STANDARDS SET FOR AIR GAGES

(P19)

Sheffield Corporation announces that type and size standards of air gages for dimensional inspection of internal diameters and bores have been established after many years of experience with flow- and pressure-type air gages.

Standards have been set up on the company's "Precisionaire" spindles for checking either "through" or "blind" holes ranging in diameter from .300" to 1.734".

#### GLASS SURFACE PLATE FLAT TO MILLIONTHS

(P20)

A new highly accurate, optically polished glass master surface plate, (Continued on page 172)

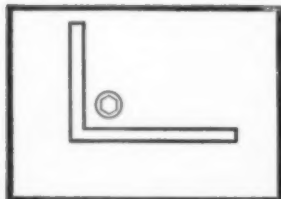


Scherr Glass Surface Plate

#### INFORMATION FREE

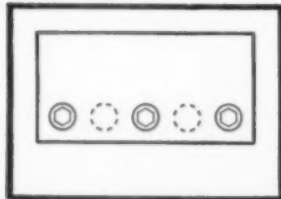
For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

## Yes, these screws save Time and Space!



No matter how close to a corner or flange you put Mac-it hexagon socket screws, there's plenty of room to drive them. This feature saves space.

\* \* \*



Mac-its are heat-treated to give far greater strength than plain steel screws. With that extra holding power, you may be able to use fewer screws — save drilling and tapping time.

\* \* \*



Production tie-ups because of broken screws are not necessary evils. Chances are that standard Mac-its will solve the problem.



**Mac-its**  
PRONOUNCED  
"MACK-IT" 4311

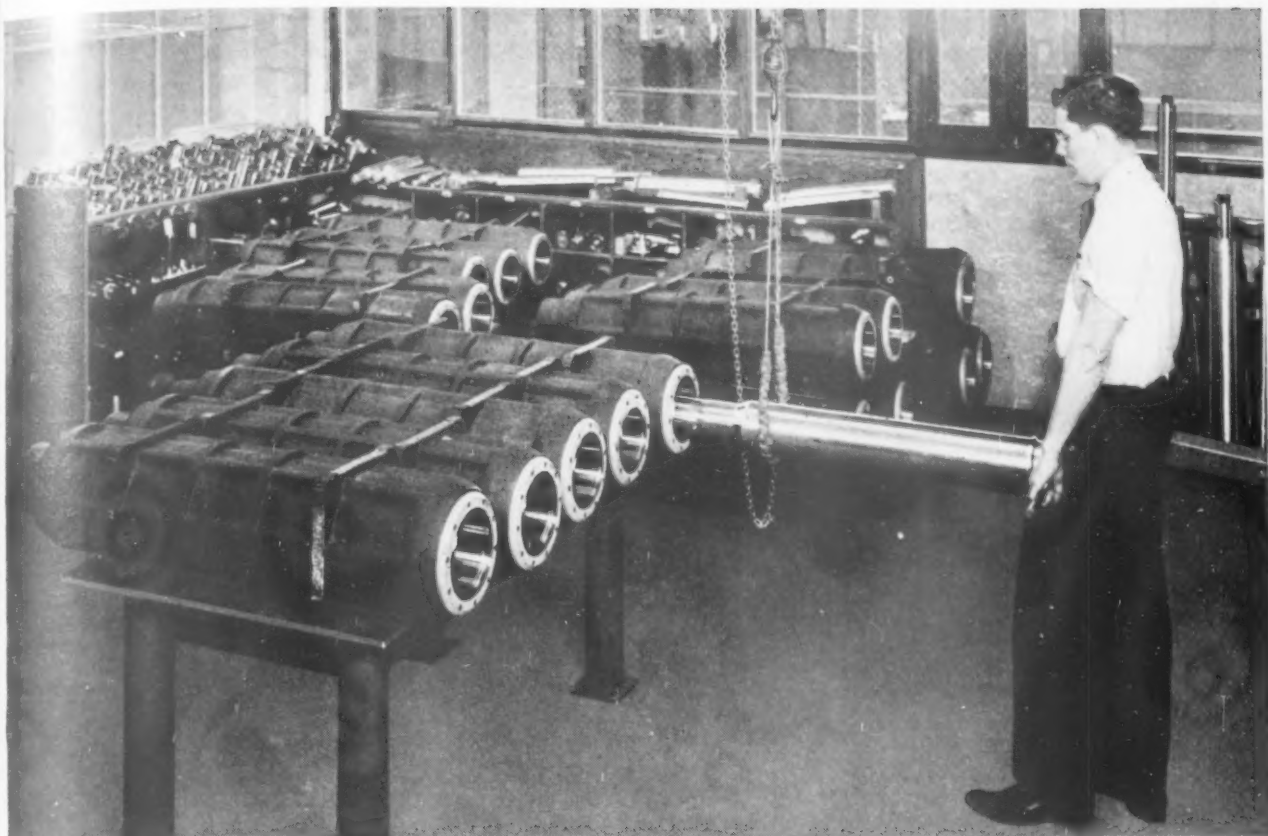
#### OTHER MAC-IT PRODUCTS INCLUDE:

Socket head and hexagon head cap screws, stripper bolts, hollow and square head set screws, hexagon socket pipe plugs.

**Strong, Carlisle and Hammond Company**

Cleveland

Ohio



Shown above: Checking Max. Profile Chamber Gage with Master Plug Gage.

## Complete Gaging Systems for **CARTRIDGE CASE INSPECTION**

System Includes:

**NEW GAGES**

**GAGE INSPECTION SERVICE**

**GAGE RECONDITIONING SERVICE**

We are prepared to supply producers of ordnance material with gages of all sizes—from the largest to the smallest, either empty case or complete rounds. You are invited to write for our **STANDARD LIST PRICES** on: 20 MM, 37 MM, 40 MM, 57 MM, 75 MM, 76 MM, 90 MM, and 105 MM sizes. Other sizes quoted on request.

**SPEED VICTORY—BUY WAR BONDS!**



# **QUALITY**

## **TOOL & DIE CO.**

405 N. NOBLE STREET • INDIANAPOLIS 2, INDIANA



**Manufacturers of "QUALITY PRODUCTS"**

flat to an accuracy of 50 millionths of an inch, has been announced by the George Scherr Co.

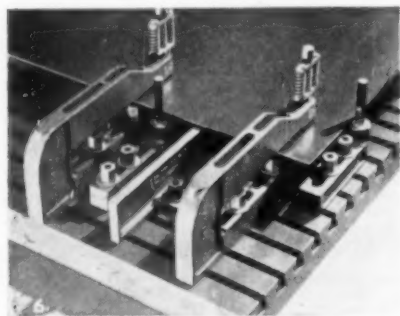
Known as Opti-Flat, the plate is extremely resistant to abrasion and is 2" thick for the 12" size and 3" thick for the 16" size to prevent warpage and breakage.

#### HOLE PUNCHING UNIT (P21) HAS WIDE APPLICATION

A new hole punching unit designated as type "BC" has been announced by Wales-Strippit Corp.

Designed to punch an unlimited number of straight line, scattered, and staggered hole patterns with varying center-to-center distances, the unit will perforate square sheared and curved sheets and long strips of flat material.

The units are made up of punches, dies, and stripping guide assemblies which are held together by holders as



Wales Hole Punching Unit

independent, self-contained units. The punch is full-floating and may be instantly lifted out of the stripping guide assembly. Various diameter holes up to 5/16" in diameter may be punched with the same unit by simply changing the punch, die, and stripping guide assembly.

#### INFORMATION FREE

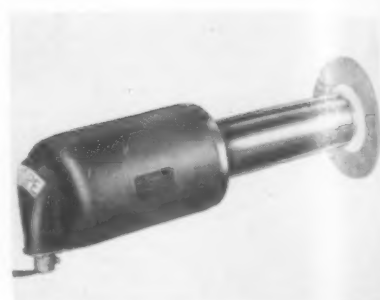
For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

#### GRINDING SPINDLE MOTOR (P22) SEALED AGAINST DIRT

Chief feature of a new motorized grinding spindle developed by Pope Machinery Corp., is a sealed motor housing requiring no fan or air passages to accumulate dirt and dust.

The only maintenance required is for the operator to keep the smooth surface wiped clean, according to the manufacturer. The unit is equipped with high-precision roller bearings and an extra heavy shaft and is completely sealed without oil cups, grease fittings, wicks, or plugs of any sort. Lubricant is sealed in and operation of the spindle is uniformly efficient throughout the life of the bearings, according to the company.

The spindle operates at any angle, is designed to provide for mounting of special tool holders or standard drill chucks, and is used regularly on 6" x



Sealed-Motor Grinding Spindle

18" surface grinders, or on boring mills, planers, milling machines and other machine tools for special work.

#### PRECISION INSTRUMENTS (P23) BROADEN GAGE USE

Designed to broaden the application of gage block for precision measurements, a new line of precision instruments has been developed by Continental Machines, Inc.

Constructed with the same accuracy as precision gage blocks, the twenty instruments of the set, in combination with gage blocks, will perform practically all precision measuring functions, according to the manufacturer. With the gage holders and caliper bars, any type of "go", "no go" snap gage can be made up in a matter of seconds, and will be accurate to millionths of an inch and as easy to use as a standard

(Continued on page 174)

## SWARTZ STANDARD DRILL JIGS AND FIXTURE LOCKS



AN APPLICATION SHOWING MERITS OF THE LS TYPE FIXTURE. ROUND CAN BE HELD AGAINST HEAVY DRILL TORQUE BY MAKING DRILL PRESSURE HELP THE CLAMPING. STEEL INSERTS SET ON ANGLE GRIP PARTS; WHILE TOP PLATE AUTOMATICALLY FOLLOWS UP ANY LOWERING OF THE WORK.

ASK FOR CATALOG 941

## SWARTZ TOOL PRODUCTS Co., Inc.

13330 Foley

Detroit, Michigan

Cleveland—J. W. Mull, Jr.  
Indianapolis—J. W. Mull, Jr.  
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Beverly Hills, Cal.—Production Tool Engineering

Oneida, N. Y.—W. F. Himmelsbach  
Pittsburgh—J. W. Mull, Jr.  
Toledo—J. W. Mull, Jr.  
Philadelphia, Pa.—Morgan Tool & Equipment Co.



*New!*  
**Ozalid  
Rapid Black**  
MARCH 1944

# *Now!* **Ozalid Transblack**

## **the first black-line, dry-developing intermediate paper**

Until now, you've been using a sepia-line paper to produce "intermediate originals" of your engineering drawings.

For until now, no manufacturer in the field has been able to create a satisfactory *black line* intermediate.

Now, Ozalid proudly offers—OZALID TRANSBLACK ... with all of these desirable characteristics:

- 1. Covering Power.** The lines of an Ozalid Transblack intermediate possess high actinic density, and produce *sharp prints without loss of detail.*
- 2. Maximum Visual Density.** An Ozalid Transblack intermediate is easier to read and work on. Furthermore, since additions in pencil or pen *match the printed lines*, subsequent prints are more uniform than those produced from a sepia intermediate with black additions.
- 3. Speed.** Ozalid Transblack intermediates can be made at fast speeds from average originals ... and will produce subsequent prints at speeds *fast* for intermediates.
- 4. Permanence.** Ozalid Transblack intermediates are *non-yellowing* and resistant to light and chemical action. Even after being filed away for years, they will produce excellent prints.

- 5. No Increase in Price.** Ozalid Transblack sells at the same price as sepia papers. Before ordering, however, send for a FREE sample package. A test in your machine will convince you of Transblack's superiority.

\*OZALID RAPID BLACK IS RECOMMENDED for producing the best "work" prints from originals or intermediate originals.

### **OZALID PRODUCTS DIVISION** **GENERAL ANILINE & FILM CORPORATION** **Johnson City, N. Y.**

Gentlemen:

- ☐ Send a FREE sample package of OZALID TRANSBLACK for test purposes.
- ☐ Send printed samples of OZALID TRANSBLACK and OZALID RAPID BLACK.
- ALSO catalog explaining Ozalid Process.

Name \_\_\_\_\_

Company \_\_\_\_\_ Title \_\_\_\_\_

Address \_\_\_\_\_

OZALID IN CANADA — HUGHES OWENS CO., LTD., MONTREAL

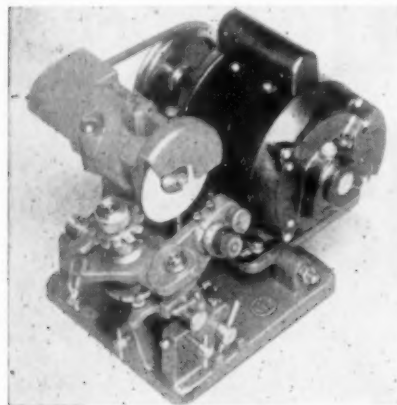
## NEW EQUIPMENT

snap gage, the company states. The instruments also provide tools to make a precision height gage, which will accurately perform all the functions of a standard height gage.

Included in this set are trammel points and center points, two quartz optical flats, a high-intensity monochromatic light, a 5" sine bar, and an adjustable vernier gage.

### NEW GRINDER DESIGNED FOR MILLING CUTTERS (P24)

A new cutter sharpener, designed for fast accurate sharpening of cutters used for gear cutting and thread mill-



Waltham Cutter Grinder

ing, as well as of circular form tools, straight-fluted hobs and multiple cut-

### INFORMATION FREE

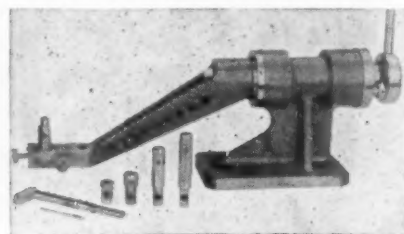
For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

ters, has been developed by Waltham Machine Works. Distribution of the machine is through Edward Blake Co.

Cutters may be sharpened radially or with any desired rake angle. Maximum capacity is 2" diameter and  $\frac{3}{16}$ " thick. The grinder is designed for bench use and is operated by a 1/6 hp motor.

### RADIUS DRESSER HAS WIDE RANGE (P25)

A new type radius dresser, adaptable to a wide range of wheel sizes, has



U. S. Tool Radius Dresser

been announced by the U. S. Tool & Mfg. Co.

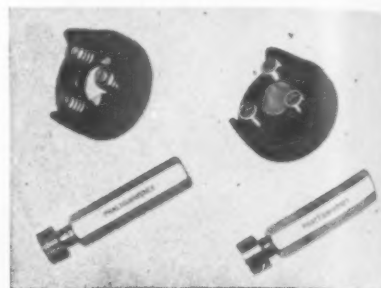
With a capacity up to 4-1/2", the dresser is furnished with three different length diamond holder bushings to

assure ample support for the diamonds, providing against chatter.

Features cited by the manufacturer are careful balancing to eliminate vibration, graduations etched on a chrome plated metal ring, a lock-stop on the spindle to provide exact location of the radius desired on the wheel being dressed, chrome plating on all unpainted exposed surfaces, and a spindle sealed against abrasive dust.

### NEW GAGES CHECK PIPE THREADS (P26)

A new line of gages designed to give a rapid, accurate check on pipe threads



P & W Pipe Thread Gages

made to the latest Army and Navy aeronautical pipe thread specifications is announced by Pratt & Whitney Division of Niles, Bement-Pond Co.

A double-end gage, provided for testing the accuracy of internal threads, (Continued on page 176)

*Consistent with our policy* "Strive to improve that which has been accepted as good enough" . . .

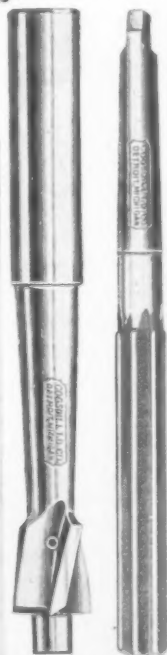
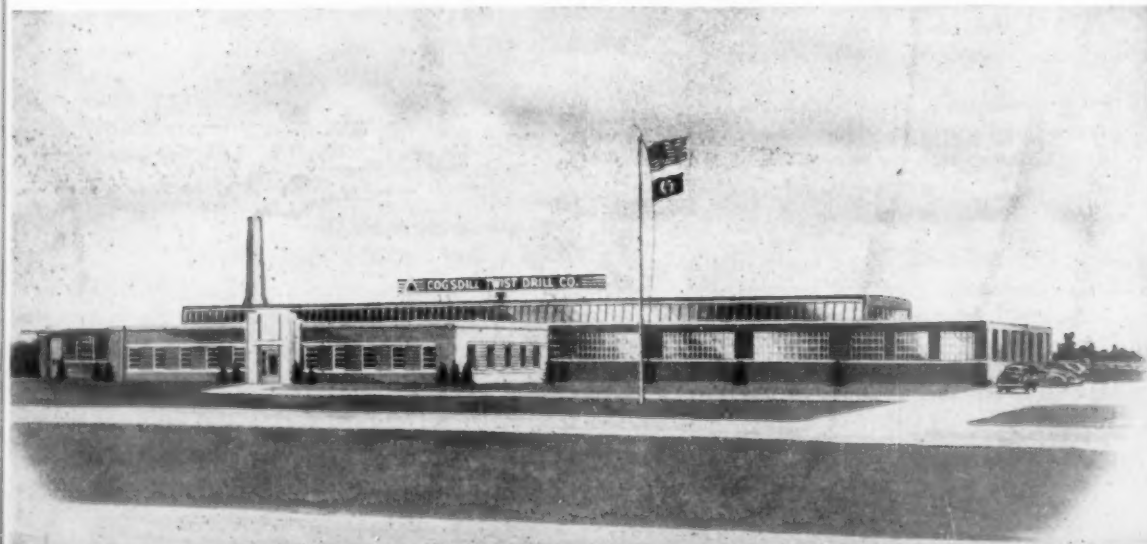
According to some standards we probably didn't need a new plant but after thirty years of just adding to production facilities as business demanded — we determined to build a plant and install equipment that could take full advantage of the fine skill of the personnel that is known to the trade as

COGSDILL . . . We are now big enough and so equipped that we can practice all of the efficiencies attending quantity production but not so big that we have lost any of the personal touch or recognition of an individual who does a job well . . . **Send for our 142 page catalog.**

**COGSDILL**

**TWIST DRILL COMPANY**  
12950 W. 8 MILE RD., DETROIT 21, MICHIGAN

ist Drills, Center Drills, Reamers, Counterbores, Bearing-izing Tools, Aeromatic Drives, Cutters, Pilots and Miscellaneous Tools



## FOR BETTER DODGING THROUGH WOLF PACKS



### ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds?
2. Obtain automatic work cycles, variable speeds in either direction . . . with or without pre-set time dwell?
3. Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities?
4. Obtain extremely accurate control of either position or speed of a reciprocating member?
5. Apply accurately variable pressure either static or in motion?
6. Closely synchronize various motions, operations or functions?
7. Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel?
8. Obtain continuous automatic reversing drives at constant R. P. M. or over a wide range of speed variation?
9. Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration?
10. Obtain constant horsepower output through all or part of a speed range?
11. Obtain automatic torque control?
12. Obtain accurately matched speed of various rotating elements?
13. Obtain constant speed output from a variable speed input?
14. Obtain full pre-set automatic control, elimination of problems of shock, vibration, etc.?

*You Need Oilgear!*



*Oilgear powers the steering gear mechanism in the world's first Victory ship . . . and subsequent ones. In addition to the greater ship maneuverability and rudder safety, Oilgear provides lower installation cost and simpler installation and immunity of control to pressure in the system.*

## IN YOUR MACHINES *Oilgear's* MORE ACCURATE CONTROL MAY MEAN FAR BETTER PERFORMANCE

The places where Oilgear Fluid Power can be used to advantage seem endless. Serving as the power link between the man at the wheel and the rudder that steers the ship, Oilgear Fluid Power provides 8 times more accurate rudder control in the new ships . . . far greater ship maneuverability and a rudder safety factor not obtained before. These same Oilgear functions, or any combination of scores of other Oilgear functions, can mean a great deal to the machine you are building or the machine you are using.

With the known wide applicability of Oilgear Fluid Power Systems, their record of success in machines, processes, war equipment, in speeding operations, bettering performance, simplifying design, and accomplishing the "impossible", we believe the soundest step you can take at this time is to learn more about Oilgear. Why don't you write Oilgear engineers today? . . . THE OILGEAR COMPANY, 1306 West Bruce Street, Milwaukee 4, Wisconsin.

# OILGEAR

## Fluid Power



# More Parts for Less Mean Larger Profits **SPEED CASE STEEL**

A LOW CARBON OPEN HEARTH PRODUCT

## INCREASED PRODUCTION

- High Speed Machining
- Heavier Cuts
- Good Finish
- Increased Tool Life



If you wrote your own specifications for the ideal, all purpose, open hearth carburizing STEEL, it would be . . .

**SPEED CASE!**

## More Parts Lower Cost!

Parts on this Universal Joint were machined at 220 S.F.P.M., drilled with a .012" feed, cross milled with a .010" cut and forming tool with a .004" feed. Even with these excessively deep cuts and with machining stepped up to 220 S.F.P.M., tool life was increased **THREE** times over SAE X1020. Estimated savings, \$49.50 per ton of steel used. TRY SPEED CASE for Increased Production, lower costs.

Write for SPEED CASE CATALOG showing savings of 20 to 65%.

**BUY WAR BONDS**

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**THE FITZSIMONS COMPANY**  
YOUNGSTOWN, OHIO

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**MONARCH STEEL COMPANY**  
HAMMOND • INDIANAPOLIS • CHICAGO  
PECKOVER'S LTD., Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

## —NEW EQUIPMENT—

checks lead, form, diameter, and taper. A plain taper plug gage is used to check taper, roundness and minor diameter. A set of two special ANPT Tri-Roll gages is used for checking external threads. One gage checks the lead, form, taper, and pitch diameter. Three steps on top of the gages classify the thread.

Taper and diameter of threads at the crest are checked with a plain taper Tri-Roll gage with a stepped plunger and three steps on the bottom for easily classifying thread. A setting plug is supplied with each of these Tri-Roll gages.

Also available is a set of three ring gages which provide an alternate method for checking external threads.

### INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

### HYDRAULIC VISE SERVES AS SMALL PRESS

(P27)

Designed for either holding or handling material or for mounting vertically.



### Reimuller Hydraulic Vise

cally and serving as a production press on small precision upsetting, heading, and other small operations requiring dies or tooling, a new hydraulic vise has been developed by Reimuller Bros. Co. Features of the vise are rugged V ways, semi-steel precision construction, and all-steel hydraulic foot control. Two foot levers are used in operation, leaving the operators hands free. No outside airlines or power are needed and the unit is self air-eliminating. It is available in two sizes—4-ton with 4" opening, and 7-ton with 7" opening.

### UNIT CONVERTS FIXTURE TO MACHINE DRILLING

(P28)

A new line of high speed carriage drill units designed for ready installation on rails fastened to an assembly fixture, is available from Farnham Mfg. Co. Addition of rails is all that is necessary to make an existing assembly fixture suitable for machine drilling, according to the manufacturer.

Designed for production drilling on long assemblies, the unit is adapted to (Continued on page 178)

# Announcing... *New*

## **JUNIOR PRESSES**

by


# *Colonial*

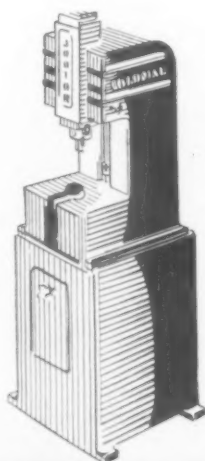
For light duty broaching or for assembling where pressures up to 4 tons are required, or for light duty straightening, etc., there is no better press than Colonial's new all hydraulic line of "JUNIORS".

Available either in bench or pedestal types and for either push or pull broaching (with special attachment). Capacities from one to four tons. Machined and counterbored platen for easy installation and location of fixtures. Plenty of daylight and clearance. Compact, powerful and sturdy. Remarkably low in cost when you consider the tremendous variety of jobs these presses can do.

For complete technical data  
write for Bulletin No. VJI-44

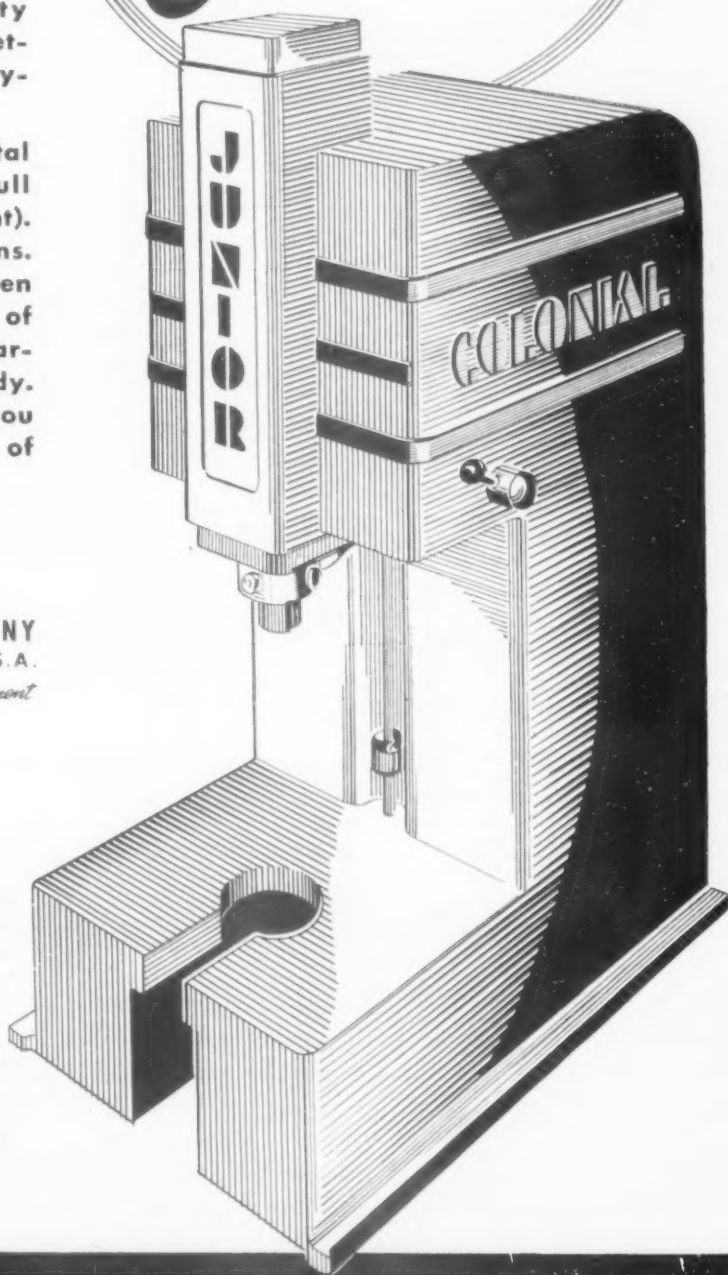
**colonial** BROACH COMPANY  
DETROIT 13, U.S.A.

Broaches  Broaching Machines Broaching Equipment



**Right** - Bench type all-hydraulic Junior Press. Also available with variable speed and pressure controls and pressure gage.

**Left** - Pedestal type Junior for press work or broaching. Also available, equipped for pull broaching.





**INVESTIGATE**

# Tannewitz

## DI-SAWS

*and You'll Want No Other!*

A broad statement? Yes. But soundly founded on facts—the experience of numerous large manufacturers — the actual performance records of the machines, themselves — and fundamental superiorities of design and construction.

Larger wheels (24" diameter on the standard models) provide greater traction, faster, straighter cutting, more production. Transmissions, common source of die saw grief, never fail in TANNEWITZ DI-SAWS.

**STANDARD MODEL No. M24  
(24" WHEELS)**

Sturdier, heavier construction throughout, plus many refinements of design, make these machines the greatest, trouble-free producers in their field. It pays to buy the best!

With a TANNEWITZ DI-SAW you can do in minutes jobs which require hours by the shaper, miller or lathe methods.

Get the complete facts. Just write for DI-SAW bulletin.

### Other Models to Handle Work of Practically Any Size

Made with 30", 36", 48" and even larger throat capacities if desired, the TANNEWITZ "Big Bertha" models make available the tremendous savings of inside and outside sawing, filing and polishing on dies, jigs and other work of practically any size. Write for bulletin.

**On request: Bulletins on Single and Variable Speed Foundry Band Saws; Sheet Metal Cutting Band Saws.**

**THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.**

#### —NEW EQUIPMENT—

##### INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.



**Carriage Drill Unit**

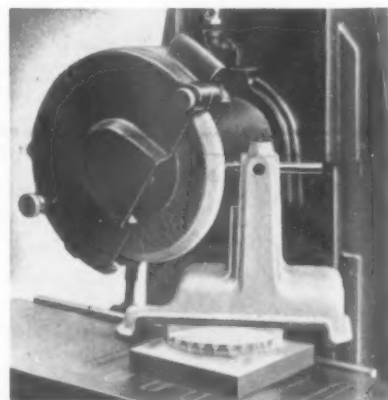
a variety of carriage mountings, both horizontal and vertical. A unit is available for use on curved surfaces and is automatically controlled by a cam to keep the drill perpendicular to the contour of the work as the carriage travels on a straight track. Drill feed, depth, and return stroke are entirely automatic. The unit is manually located in a jig hole and the automatic cycle started with a push button.

##### **WHEEL DRESSER DESIGNED FOR INEXPERIENCED HELP (P29)**

Said to make it possible for an operator of limited experience to dress abrasive wheels accurately to any contour, a new precision tool has been developed by Best Tools Corp.

Contour dressing is accomplished by placing a steel template, of the desired contour on the base held in place with a clamp. The base is placed against the gage on the back of the magnetic chuck of the surface grinder, the head is lowered into position, and a spring-activated tracer point comes in contact with the template. The tracer point follows the contour of the template and in turn a chisel pointed diamond generates the same contour on the abrasive wheel.

THE END



**Abrasive Wheel Dresser**

THE TOOL ENGINEER



## WETMORE adjustable blade REAMERS

*For low cost precision holes...*



**and finer finish...faster**

### Wetmore type 7 shell reamer

• Wetmore shell reamers are modern tools—precision built for precision work. They have the exclusive Wetmore features that assure top production, finer finish and economy of long tool life. Wetmore shell reamers are available in sizes from 1-1/4" to 6" cutting diameters, with right or left hand angle blades in carbide or high speed steel.

When the job requires precision reaming, high production and low cost—it's an ideal job for Wetmore tools. That is why they are widely used in so many top-flight metal-working plants.



Send for this New Tool Guide—it is full of data, information and specifications... Free to executives and engineers.



Arbors for Wetmore shell reamers are available in straight or tapered shanks.

**WETMORE REAMER CO.**

409 No. 27th Street

Milwaukee 8, Wis.



# SPEED UP your PRODUCTION with the



## ANDERSON POWER SCRAPER

Has a "natural hand control" . . . as easy to use as a hand scraper. Left hand serves as guide to the blade . . . right hand controls stroke. Pressure of left hand controls depth of cut, but forward cut requires no backbreaking labor. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to  $3\frac{1}{2}$  feet . . . 60 feet per minute, reverse speed 90 feet per minute. Operator can work at a steady rate without tiring as  $\frac{1}{4}$  h. p. motor does heavy cutting. With this machine one man can do the work of several.

The Anderson Power Scraper, mounted on an elevating truck is easily moved to any location. Machine may be plugged into any electric lamp socket and be ready for use. In scraper housing directly across from motor is a scraper blade grinder . . . a convenient, speedy means of resharpening scraper blades without leaving machine.



MODEL HP-010-P

## HYDRAULIC POWER PRESS

*For Faster checking  
and straightening*

The Anderson Press reduces costs to a minimum on checking and straightening operations. Necessity of moving shafts from anvils to centers for checking has been eliminated as checking and bending is done in the same position.

Attachments for Press include checking rolls for checking straight bars or parts

that have same diameter on ends, and centers for checking stepped or odd shaped parts with centers. Checking rolls and centers are spring mounted so that when pressure is applied to part to be straightened the rolls are depressed allowing part to rest on anvils. When pressure is released, spring tension of rolls or centers brings shaft clear of anvils and free to rotate. Rolls and centers easily adjusted for different lengths of work and may be removed altogether if necessary.

Another attachment is an indicator gauge calibrated in thousandths for locating high and low spots on work, and it also shows how much shaft is bent when pressure is applied.

A pressure gauge calibrated in pounds of ram pressure is standard equipment. Pressure required to straighten a part can quickly be determined by operator.

For a production job with many diameters several indicator brackets can be mounted in the front of press and multiple diameters checked at the same time.

ANDERSON BROS. MFG. CO.

**Anderson**

ROCKFORD, ILL. U.S.A.

*Get all the Facts  
Write for Bulletin 710*

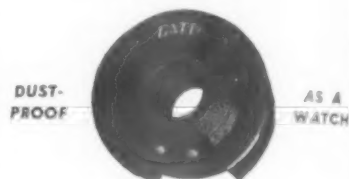
## LESS OPERATIONS AND FAR BETTER WORK WITH A

**GATCO**

### ROTARY PILOT BUSHING

Pilot bushing fits with a PUSH fit, therefore a perfect bore

**ROUND-CHATTERLESS-  
SMOOTH**



GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

Write for full information and prices

**GIERN & ANHOLTT TOOL COMPANY**  
1308 Mt. Elliott Avenue, Detroit 7, Michigan

## WIRE ROPE CUTTER

Hand Power

Lever Action

Weight 110 lbs.

Price \$80.00

Immediate shipment  
from  
New York stock.



Lewthwaite No. C

The compactness and durability of this tool make it particularly adaptable for shipyard or field work.

All tools are thoroughly tested before leaving our plant.

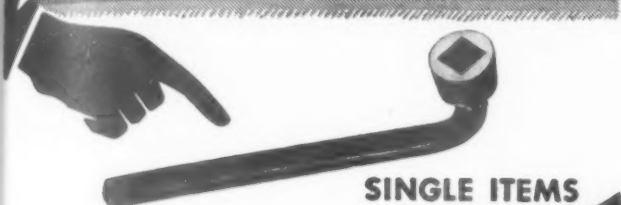
Catalog No. 8 on request

**T. H. LEWTHWAITE  
MACHINE CO.**

307 E. 47th Street, New York 17, N.Y.

**GIVE YOUR  
EQUIPMENT A  
CHANCE TO LIVE**

**FURNISH FAIRMOUNT  
SERVICE TOOLS WITH  
YOUR PRODUCT**



**OR COMPLETE  
SERVICE KITS**



The life and operating efficiency of your product depends on proper servicing

with the right tools. Whether it takes special tools or a standard kit to do the job properly — FAIRMOUNT Tools can be depended upon to keep your product in condition. Don't slight the final accessory — specify FAIRMOUNT TOOLS.

**The FAIRMOUNT**



**TOOL & FORGING COMPANY**

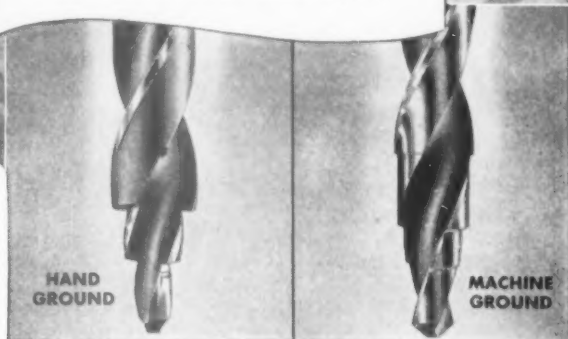
Hand Tools • Special Tools • Forgings

10611 QUINCY AVENUE • CLEVELAND, OHIO

JULY, 1944

## Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.



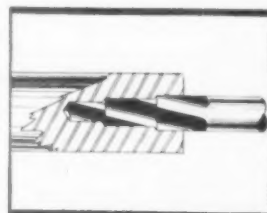
## New Precision Step Drill Grinder Simplifies Production and Maintenance of Step Drills

The quality of a step drill produced by common methods depends almost entirely on the skill and attention of the individual tool maker. However, with the development of the precision step drill grinder, the human element has been entirely eliminated, the characteristics of the step being completely controlled by the grinding machine without adjustments during the course of grinding. This automatic feature insures absolute uniformity, regardless of quantity, and permits large-volume production of step drills.

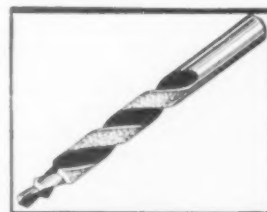
The apparent advantages gained through the use of the step drill grinder are: Permits mass production of drills ground to exact specifications, entirely independent of the human element. Maintenance, too, is no longer an obstacle as step drills produced by this method are quickly sharpened by the same uniform machine-controlled operation. With the step drill grinder step drills can now be made from standard drills. These advantages result in a wider application of step drills which provide a definite saving of machine tools, man-hours and cost; this in turn results in greater production.

You know there are plenty of benefits in chewing gum, too. That's why all of the Wrigley's Spearmint we're able to make from our available stocks is going overseas to our fighting men and women. You know what a lift it's been on the job and we wish we could supply everybody, because we have pride, too, in our workmanship and productivity. But there just aren't enough available top quality raw materials right now to do it. When we can produce it in sufficient quantity, it will be back to you with the same fine flavor and chewing satisfaction . . . Wrigley's Spearmint has never been changed!

You can get complete information from Spiral Mfg. Corp., 5022 North Kedzie Avenue, Chicago 25, Illinois.



The above illustration shows mechanical design which requires a hole having diameters diminishing in steps. This is an operation for step drills which has often been neglected due to difficulty in obtaining and maintaining step drills.



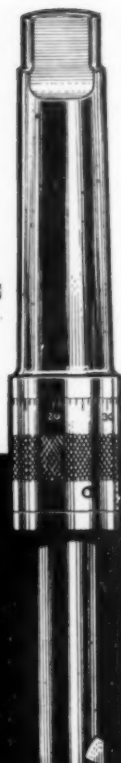
Step drills produced by our method are quickly sharpened by the same uniform, machine-controlled method.

Y-126

181



# UNIVERSAL MIKRO-LOK BORING BARS



Universal Mikro-Lok Boring Bars are designed for finishing cuts where extreme accuracy is required. For jig boring, diamond boring and screw machines. Especially adapted for boring to a shoulder, or to the bottom of a hole or where intermittent cuts are being taken. Extremely rigid. Easily and quickly adjusted like a micrometer to limits of .0005 or less. Available singly or in sets. Write for facts and prices.



**UNIVERSAL ENGINEERING CO.**  
FRANKENMUTH, MICHIGAN

## New! *Hammond* SAFETY FEATURE!



New safety cup disc, standard equipment, is the greatest safety unit ever installed on any carbide tool grinder. It prevents the operator getting fingers, or dropping tools, into cup of cup wheel. It is an integral part of cup wheel hood design, adjustable for wheel wear. Investigate . . . compare! Hammond's complete line, from chip breakers to 20" grinders, gives you complete facilities for carbide tool maintenance.



*Hammond*  
*Machinery Builders*  
INC.  
KALAMAZOO, MICHIGAN

WRITE FOR COM-  
PLETE CARBIDE  
BULLETIN

1636 DOUGLAS AVENUE  
Eastern Branch: 71 W. 23rd St., New York, 10, N.Y.

# SHORT CUTS

WITH  
MAGNETIC  
CHUCKS  
FOR  
TOOL ROOM  
AND  
PRODUCTION



These illustrations show a few of the many grinding operations made possible by using Power Grip Magnetic Chucks. The small pieces illustrated have been ground true to the shoulder without extra jigs or fixtures by spacing the chuck and parallel.

110 Volts A. C. transformed and rectified through our efficient, enclosed, dry plate control Unit to 6 Volts D. C., which energizes the Magnetic Chuck. A safety against shocks and burn outs.

**ROCKFORD MAGNETIC PRODUCTS CO.**

1015 Sixth Ave. — Rockford, Ill.

## "ROCKWELL" HARDNESS TESTER



Shipment within a few days of these  
enormously improved new models

383 CONCORD AVE.  
NEW YORK 54, N. Y.

**WILSON**  
MECHANICAL INSTRUMENT CO., INC.

# CIRCLE®



## SCREW SLOTTING SAWS



2 1/4" diameter



2 3/4" diameter



1 3/4" diameter



Used by most of America's larger screw manufacturers, these Circle R saws are made of selected high speed steel. Like all Circular Metal Cutting Tools they are designed by specialists to successfully accomplish the most exacting operations.

Complete stocks of these sizes are available.



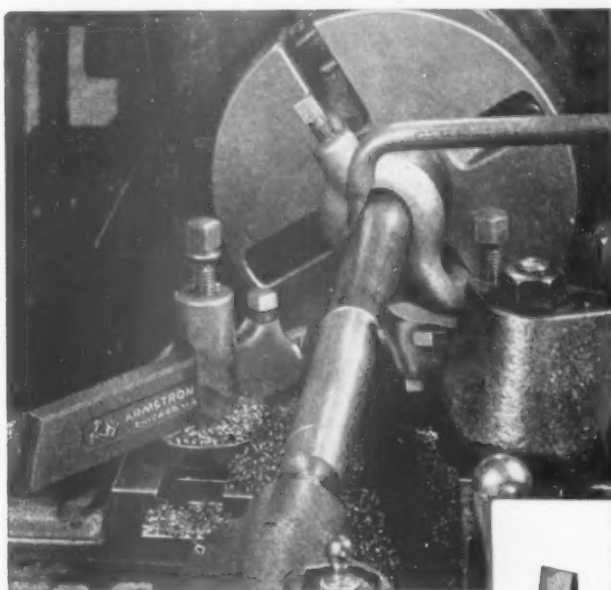
For detailed information on these and other Circular Saws send for Catalog K. NOW!

**CIRCULAR TOOL CO., INC.**  
PROVIDENCE 5, R. I.

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# ARMSTRONG

## Carbide TOOL HOLDERS



## Standard Shape Armide Cutters

Armide (Carbide Tipped) Cutters and ARMSTRONG Carbide TOOL HOLDERS can increase your output on long-runs and tough or hard steels. They increase the interval between tool re-grindings from 20 to 50 times. They cut the toughest and hardest steels easily.

Armide Cutters come in 5 standard cutting shapes—"A" Right-hand Turning, "B" Left-hand Turning, "C" Square Nose, "D" Round Nose (for general turning and facing), and "E" 60° Threading. 10 sizes.

ARMSTRONG Carbide TOOL HOLDERS, come with "Straight", "R. H. Off-set" or "L.H. Off-set" Shanks. They hold cutters at 180° (proper for carbide) provide extended, close-up support to the cutting edge, and are extremely rigid.

Write for "Carbide" Circular.

**ARMSTRONG BROS. TOOL CO.**

"The Tool Holder People"

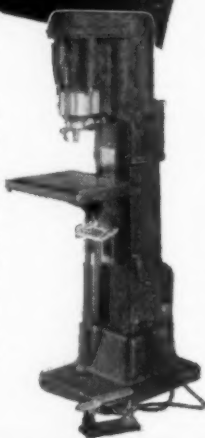
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Eastern Warehouse & Sales:  
199 Lafayette St., New York



**IT'S IN THE** *Air!*

**AIR CONTROL is the Secret of precision tapping The Haskins Way**

Accuracy—to a class 4 fit when necessary—is constant—each part is tapped exactly like every other, independent of operator efficiency. AIR regulates the complete tapping cycle—not only the down stroke, but its control is so sensitive that the tap is allowed, in effect, to float out of the part. Tap life is longer—tap breakage practically eliminated. Send today for your copy of catalog on Tapping—The Haskins Way. R. G. Haskins Co., 2756 W. Flournoy St., Chicago, Illinois.



**haskins**

PRECISION TAPPING EQUIPMENT

*What I Like About*  
**DE-STA-CO  
ARBOR SPACERS**

De-Sta-Co spacers save a lot of time when setting milling machine cutters . . . they do away with much idle machine time and thus increase production . . . they are offered in all standard arbor sizes and in thicknesses from .001" up, including long spacers cut from bar stock and ground to decimal . . . they are made from metal and therefore are not affected by temperature changes . . . they may be used over and over again, which makes them the lowest in cost of any arbor spacers you can buy.

SEND \$1.00, giving us size of your arbor, and we will send you a special trial assortment of spacers, sufficient for average use on a machine.

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*Established Over 25 Years*  
356 Midland Ave • Detroit 3, Mich.

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Forgings For All Industries  
Rough Turned or Finished Complete



Composite Die Sections  
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Rings, Discs, Blocks,  
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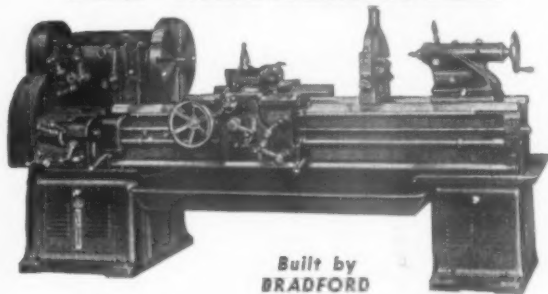
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**LOWER COSTS WITH  
THE METALMASTER**



Built by  
**BRADFORD**

● The high-quality construction of this Bradford lathe will reduce your production costs by giving uninterrupted service over long runs.

● Sturdy construction, precision spindles, long-wearing bearings, special alloy gears, and many other features combine to give trouble-free performance and long life.

Also manufacturers of drilling and tapping equipment



1840 - 1944

Bradford's experience in building metal-working machinery covers more than a century.

**THE BRADFORD  
MACHINE TOOL CO.**

EVANS STREET SOUTH OF EIGHTH CINCINNATI, OHIO  
PRECISION TOOLS SINCE 1840



Take the "GUESS"  
Out of Inspection



Check Your Gages Daily

Be sure that every shipment of parts will be accepted. Avoid delays and extra man hours required to replace orders of important products because of dimensional inaccuracies.

DoALL GAGE BLOCKS



The modern key to exactness and precision in experimental laboratory, tool room and on production lines. To take care of every gage block need, DoALLS are furnished in three different accuracies:

Laboratory Set — 2 millionths of an inch

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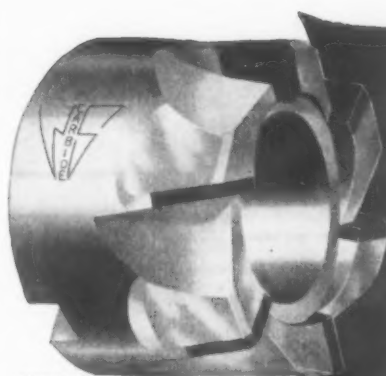
Working Set — 8 millionths of an inch

FREE—Handbook of Scientific Inspection. Tells about the many uses and advantages of DoALL Gage Blocks. Just write for a copy of "QUALITY CONTROL".



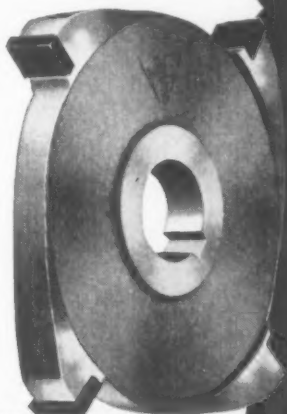
CONTINENTAL MACHINES, INC.

Manufacturers of DoALL Contour Machines and Surface Grinders. Offices in Principal Cities  
1304 S. Washington Ave., Minneapolis, Minn.



#### SHELL END MILLS

Tool No. SEM for cast iron and non-ferrous materials. Tool No. SSM for cutting steel. Sizes: 1/4" to 6". 4 to 10 teeth. Use up to 20" table feed per minute.



#### MILLING CUTTERS

Five tool styles for milling steel and non-ferrous materials. Diameters: 3" to 8". 4 to 10 teeth.

Again

WENDT  
SONIS

STANDARDIZES

another group of  
carbide tipped  
tools

They're here! They're New! They're Standard! These Wendt-Sonis cutting tools are especially designed carbide tipped cutting tools—not adaptations of high speed steel designs.

#### DISTINCTIVE CHARACTERISTICS—

1. New flute angles
2. New fillet designs
3. New shank designs

—plus 25% longer carbide tips on all round tools. All these new tools—many of which were formerly classed as "special" are now standard and listed in new W-S Catalog No. 144. Order through your nearest Wendt-Sonis distributor . . . or write to WENDT-SONIS COMPANY, Hannibal, Missouri or BRANCH WAREHOUSE, Long Beach, Calif.



NEW!

W-S Catalog No. 144 just off the press. Contains all new standardized tools and latest prices. WRITE TODAY for your FREE copy.



SPIRAL REAMERS



JOBBER REAMERS



END MILLS



COUNTERBORES and SPOTFACERS



FLY CUTTERS



CUT-OFF TOOLS



GRINDER HALF CENTERS



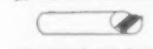
STUB SPOTFACERS



INVERTED TAPER SHANK ROUTER BIT



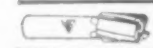
SLOTING CUTTERS



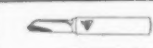
BORING TOOLS



ROLLER TURNING TOOLS



SPIRAL END MILLS



ROUTER BITS

WENDT  SONIS

CARBIDE TIPPED CUTTING TOOLS

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# NEW LITERATURE

OF INTEREST TO PRODUCTION EXECUTIVES

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

## (1061) Shapers

General Engineering & Mfg. Co. has available a new bulletin, designated as GC-12 dealing with the company's multi-purpose crank shapers. The publication illustrates and describes the company's three types of shapers and lists applications of each. It also describes the Lubrigard, an automatic safety feature which protects the machine against lubricating deficiencies.

## (1062) Electric Hoists

Harnischfeger Corporation has available a new bulletin designated as H-23, listing operating and construction details of the company's new 500-pound electric chain hoist. It also includes condensed specifications, clearance data, and typical installation photos.

## (1063) Cutter Sharpener

Designated as No. 471-44, a technical bulletin is available from Michigan Tool Co., describing the company's new resharpener checker for hobs, milling cutters, and form cutters. The bulletin contains machine details and specifications, and illustrations showing the method of operation in making

### INFORMATION FREE

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various checks, using the two standard and two special indicator assemblies.

## (1054) Fixtures

Hardinge Bros., Inc., have announced a new bulletin illustrating and describing an addition to its line of collet index fixtures. The bulletin explains fully the principal features of the fixture—a spindle with a threaded nose to take jaw chucks and step chucks and closers, as well as standard 5C Hardinge collets.

## (1065) Miller

The Cincinnati Milling Machine Co. announces a new catalog covering its 28" Vertical Hydro-Tel Milling Machine. Designated as M-1284, the publication contains complete drawings, including dimensions for raised-bed and multiple-spindle machines, a description of the 360° Automatic Pro-

filig Unit and illustrations showing machines in the field and tooling up for specific types of work. In addition, it includes a complete list of specifications.

## (1066) Oil Reconditioner

Designated as bulletin YM-700, a new publication has been issued by The Youngstown Miller Co., covering its Robot Oil Reclaimer. It illustrates, describes, and gives specifications of the machine, and also gives complete operating instructions.

## (1067) Clamps

Grand Specialties Co. has released a new catalog containing information on its complete line of speed clamps. It includes details on the company's speed clamps; V-jaws; bar-clamps; V-clamps; Quick Locket for aluminum, soft metals and fabrics; machinist's "C" clamp; welder's clamp, and replacement parts for all clamps.

## (1068) Metal Cutting

Peerless Machine Co. has available a bulletin designated as HC-50, containing complete information of its Hydra-Cut metal cutting saw. It

(Continued on page 188)

# AMES No. 13 COMPARATOR

.001" Model \$30.00  
.0005" Model \$30.00  
.0001" Model \$45.00

For accurately measuring large, small and odd shaped parts speedily, this No. 13 Comparator is popular and attractive. The 8" square base is ground flat on top and often fitted with V blocks, anvils and stops of various kinds. The bracket which holds the 2 1/4" indicator extends 4" over the base and is adjustable for measuring up to 6".

There are many uses for this inexpensive, durable, high-grade Comparator in every shop where accuracy is essential.

SEND FOR  
CATALOG

**B. C. AMES CO.**  
WALTHAM, MASS., U. S. A.

# PRECISION HAS FAILED!

(A DISCUSSION OF TODAY'S  
ASSEMBLY PROBLEMS)



When there is a rejection of a precision-part assembly in any plant, Precision has failed.

When there is varying performance of two or more mechanisms assembled from interchangeable, identical precision parts, Precision has failed.

Take issue if you will, but why will your precision products vary?

Why will two identical pumps, generators or other mechanisms have varying performance characteristics? Why will one automobile operating under the same conditions as its twin achieve superior mileage or performance?

Although through science and craftsmanship interchangeable parts are being produced to extreme tolerances, the application of this precision—Precision of Assembly—depends on the man or woman with the wrench. And what does he or she know about ten-

thousandths of an inch? Or half an inch-pound torque? Some understand. Most do not.

Case histories in our files offer illustrative proof that the man or woman with the wrench is the decisive factor in final precision.

Douglas Aircraft Company, in one instance, reduced inspection complaints on an assembly from 100 to 6 per day by giving the man with the wrench the proper tool for Precision Assembly.

In our work with many leading manufacturers, we have been able to help them reduce rejects, cut costs, achieve identical peak performance operation of precision mechanisms, produce faster.

One of the requisites to Precision Assembly is precision torque. Let our engineers discuss this particular phase of manufacturing with you. Write to Department TE-7.

## **RICHMONT, INC.**

Originators of Precision Assembly Methods • Manufacturers of the Livermont Torq-Stop Wrench, the precision production-line torque wrench  
215 West 7th Street, Los Angeles 14, California

• Eastern Representative, 428 New Center Building, Detroit 2, Michigan

JULY, 1944



lists complete specifications, features, and attachments, together with illustrations of the machine in action. Also available is a one-page leaflet on the company's adjustable stock rests.

#### (1069) Chucks

**The Handbook Of Chucks.** 32 pages. Westcott Chuck Co. Written primarily for students and newcomers to the metal-working industries, the handbook explains the fundamental construction and uses of chucks. Well illustrated, it contains information on the chuck, the modern chuck, uses of the chuck, mounting on a lathe spindle, loading a work piece, unloading work and unmounting the chuck, how to change jaws, how to reverse jaws, and chuck maintenance.

#### (1070) Tap Extractors

The Walton Co. announces new literature dealing with the Walton Tap Extractor. The publication deals with simplicity of operation, immediate delivery, and the company's free conditioning service.

#### (1071) Abrasives

Carborundum Company announces a new booklet giving complete details of "MX" products manufactured by the company. It describes features of its straight wheels, mounted wheels and sticks, and other abrasive products. An excellent feature of the booklet is the five-page section of pictures showing various applications of MX products in action. Complete speci-

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cations of the various products also are included.

#### (1072) Plastics

A new folder dealing with "Toolite" a thermosetting phenolic plastic for casting tools, dies, and fixtures is available from Adhere, Inc. The booklet explains the properties, characteristics, and procedures of the plastic, together with illustrations showing the steps in producing tools, dies, and fixtures with the material.

#### (1073) Hydraulic Machine

Barnes Drill Co. has available a new bulletin dealing with its standard hydraulic units arranged vertically, angularly, or horizontally for special drilling, reaming, facing, boring or tapping operations. Designated as bulletin No. 150, the publication lists features and specifications of the hydraulic unit. It also contains illustrations and descriptions of the machines for various applications.

#### (1074) Metals

A new bulletin designated as No. 18 and entitled "Meehanite, the Metal for Post-War Castings," has been released

by the Meehanite Research Institute of America. It describes a variety of recent applications of Meehanite castings for highly stressed parts, formerly specified as steel or high alloy castings.

#### (1075) Degreasing

Written by a leading metal cleaning engineer, a new manual on vapor degreasing has been published by The Phillips Mfg. Co. The illustrated handbook takes up every phase of vapor degreasing in clear, concise question and answer form. It includes types of work that can be handled by vapor degreasing, recovery of solvents, toxicity, degreasing of bowl-shaped parts, proper size of degreasers, special uses for degreasers, and many other topics.

#### (1076) Welding

C. E. Phillips & Co. has published a handbook of engineering data, welding procedures and heat-treating procedures for tool and die steels. Entitled "Arc Welding in the Maintenance and Construction of Tools and Dies" it deals with a selection of electrode material, types of electrodes for a certain range or group of steels, heat-treatment data, deposit characteristics, physical properties, and special details of application procedure. The book is well illustrated with typical applications.

#### (1077) Dust Collection

**Air Processing Equipment.** 56 pages. Peters-Dalton, Inc. This book illustrates (Continued on page 190)

HOW AMERICAN ENTERPRISE PRODUCES MORE, FASTER, BETTER—  
WITH BOWSER EXACT LIQUID CONTROL

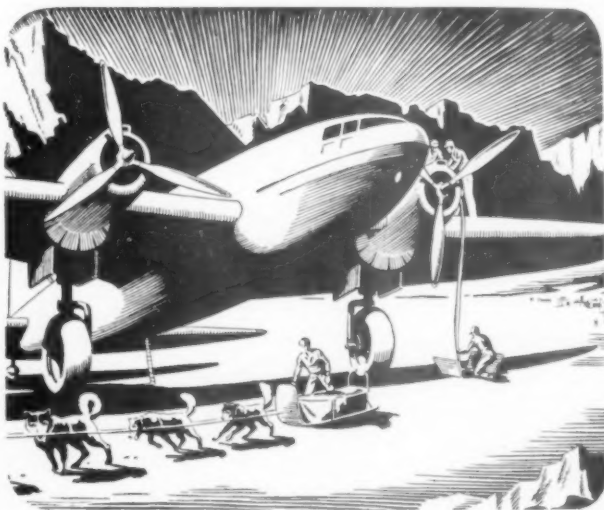
## Up where sawmills have to be flown in... Bowser Engineered Fueling Systems

Installing airports and fueling systems on the route to Alaska operated by Northwest Airlines for the Army Air Forces, was a mighty tough job. The route was largely through primitive country, some of it so isolated that ground transportation methods were useless. For instance, a 24-bed hospital was flown in. So was a sawmill. That gives you an idea of the problems.

Bowser Fueling Systems were chosen for three major reasons:

1. In airport operations in many countries, under all extremes of conditions, Bowser Systems have proved superior in the delivery of clean, dry, safe fuel.
2. Bowser designs and builds systems to meet virtually every kind of special requirement, however unusual.
3. Bowser-built equipment has established records for dependability and efficiency in hundreds of industries over scores of years.

Airport fueling systems are a specialized field, of course. But Bowser specializes in every phase of exact liquid control. Bowser Meters, Proportioners, Filters, Lubrication Systems, Pumps, Stills, etc., have indispensable appli-



cations in almost every factory.

Here's a typical example: A plant in upper New York State installed a Bowser Pressure Filter for cutting oil. First job was reclaiming oil that had been in use five years and was terribly dirty. Two processings restored it to original color. Cutter life between grinds was increased approximately 100%. Note this, too—Dermatitis cases (skin infection, due to contact with oil) dropped appreciably immediately after the filter went to work. Those points add up to a major economy. BOWSER, INC., Fort Wayne 5, Indiana.



Not only has Bowser's war production earned the Army-Navy E...  
Bowser equipment has helped earn it for scores of other companies.



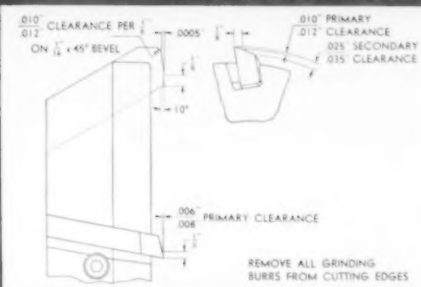
The Name That Means  
EXACT CONTROL  
of Liquids

# INGERSOLL Grinding Chart

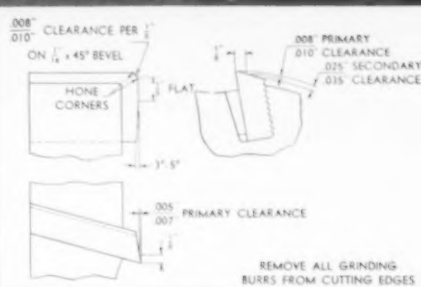
## BASIC GRINDS FOR STANDARD CUTTERS



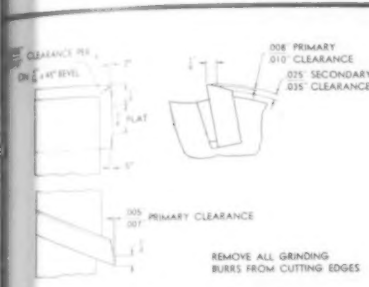
GRIND 1. Rough Milling Cast Iron.



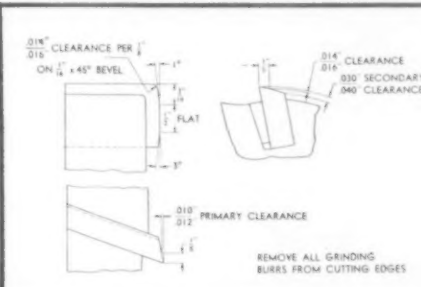
GRIND 2. Finish Milling Cast Iron. The .0005" high heel may have to be changed to suit the tilt of the spindle. This can be determined from the finished surface.



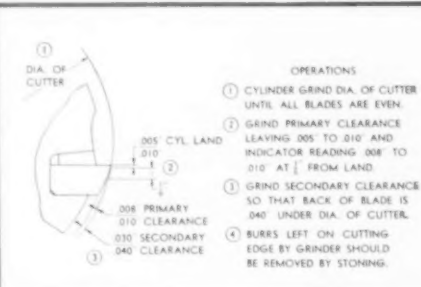
GRIND 3. Rough Milling Low Carbon Steel.



GRIND 4. Finish Milling Low Carbon Steel. If chatter is encountered, reduce the length of flat on face.

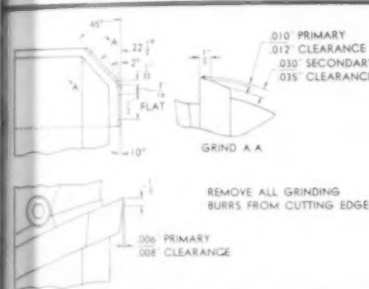


GRIND 5. Rough and Finish Milling Aluminum. Hone to a keen smooth cutting edge.

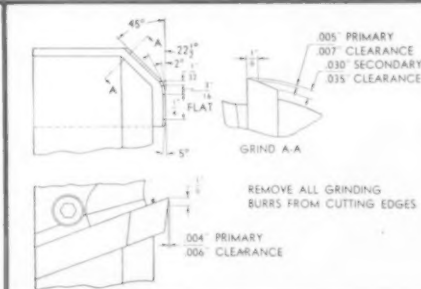


GRIND 6. Helical Slab Milling Cutter.

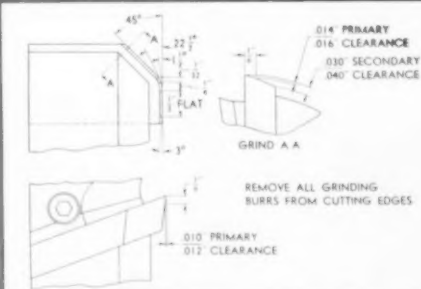
## BASIC GRINDS FOR INGENSOLL SHEAR CLEAR CUTTERS



GRIND 7. Milling Cast Iron.



GRIND 8. Milling Steel.



GRIND 9. Milling Aluminum. Hone to a keen smooth cutting edge.

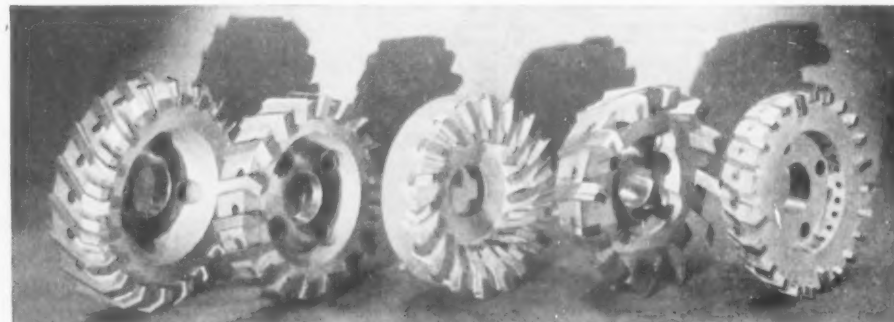
**NOTE:** Copies of these charts, suitably mounted for hanging in your tool room, are available upon request.



To obtain best results with your milling cutters it is essential that they be properly ground. Minor variations may be necessary to suit particular conditions, but satisfactory results will be obtained if cutters are ground in accordance with these charts.

For further information on the technique of grinding milling cutters write for Ingersoll Bulletin No. 54 describing the Ingersoll Cutter Grinder.

Ingersoll manufactures inserted blade milling and boring tools of all types. These are shown in our Engineering Specification Sheets available on request.



SHEAR CLEAR NX RAY BLADE Heavy CONE TYPES Medium

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

trates many of the installations of the company's dust collecting units and systems, spray booths, ovens, and ventilating and air-processing systems. It also includes engineering data of dealing with air-handling problems. Requests must be on company letterhead.

**(1078) Springs**

Muehlhausen Spring Corporation has available a new booklet illustrating production methods used in making its large hot-coiled springs. It describes how the springs are coiled and describes various types available.

**(1079) Molding Machines**

Watson-Stillman Company has announced a four-page bulletin describing a new line of horizontal injection molding machines. It includes specifications covering five models, with hopper feed capacities ranging from 6 to 24 ounces, detailed drawings, and complete data on operating features.

**(1080) Welding**

General Electric Company has available a 28-page booklet dealing with resistance welding. It covers resistance welding methods and equipment, selection of equipment for best results, welding electrodes and their maintenance, material and preparations for welding, and a master chart of welding processes.

**(1081) Gages**

Fonda Gage Co. has available a new

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four-page folder dealing with its precision gage blocks. It lists eight important points in selecting gage blocks, describes the company's method manufacture, and contains complete specifications on Fonda gage block sets.

**(1082) Gages and Carbide Tools**

Designated as catalog No. 102, a new 36-page publication containing engineering data and description of the Metro line of precision gages and carbide-tipped tools is available from Metro Tool & Gage Co. Included is information on thread plug, thread ring, taper pipe thread, cylinder plug, cylinder ring, master, and carbide gages; precision surface plates; and duplex bench blocks. Carbide-tipped cutting tools, centers, and masonry drills also are discussed.

**(1083) Hole Punching**

Catalog "BC" just released by Wales-Strippit Corp., illustrates and describes the company's latest addition to its line of hole punching equipment. It describes the company's type "BC" units designed to punch holes in flat sheets, to provide stripping action and to set up to punch unlimited patterns

of holes on T-slotted plates and templates in stamping presses and on T-slotted plates and bed rails in press brakes. The set up methods are fully described.

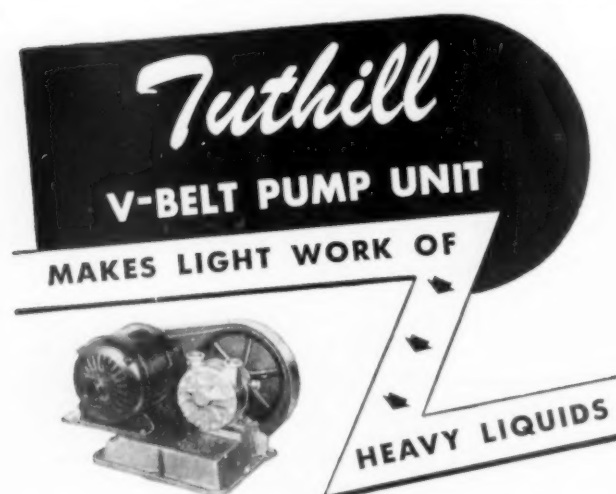
**NEW BOOKS**

**Broaches and Broaching.** 97 pages. The Broaching Tool Institute. Price \$3.00.

This complete treatise on broaching endeavors to present broaching practice and technique as it is today, while recognizing that broaching technique is advancing rapidly and that subsequent editions to supplement this first edition may be necessary in the future. Extremely well written and well illustrated, this handbook covers the historical background of broaching and the entire field on advanced broaching practice.

Subjects discussed are advantages, application, and limitations of broaching, types of broaches, cutting action, material, broach design, cost practice, information needed for design and manufacture of broaches, handling, and sharpening broaches, broaching machines, setting up the broaching machine, fixtures, and cutting fluids.

This book is recommended equally to the novice who seeks a fundamental catechism of the broaching operation and to the more advanced machinist interested in obtaining the latest information on broaching technique.



**Tuthill**  
**V-BELT PUMP UNIT**  
**MAKES LIGHT WORK OF**  
**HEAVY LIQUIDS**

For efficient handling of viscous liquids, this compact V-belt driven Tuthill pumping unit is outstanding. Quiet in operation. Simple in construction. Built for long service with negligible maintenance. Features include internal gear rotary pumps, outboard ball-bearing shaft support, belt tension adjustment by one set-screw, wide range of speeds, capacities and pressures. Write for viscous liquid pump bulletin.



**TUTHILL**

**SERVING ARMY  
NAVY • AIR FORCE  
MERCHANT MARINE**

**TUTHILL PUMP COMPANY**

939 E. 95th ST. • CHICAGO 19, ILLINOIS



**A Natural...**  
**IN ANY SHOP**  
**Self Centering  
Shaft Vise**

This modern machine vise is a "natural" because it just naturally is an asset to any machine shop. For machining slots and keyways in shafts or spindles,  $\frac{3}{8}$ " to  $3\frac{1}{8}$ " diameter—suitable for horizontal or vertical mounting. Setting of vise remains unaltered for

all work diameters—insures accurate radial cuts. Hardened V jaw reversible in vise—equal movement of two jaws locates shafts correctly in V jaw.

Base size 8" x  $7\frac{1}{4}$ ". Approx. wt. 80 lbs.

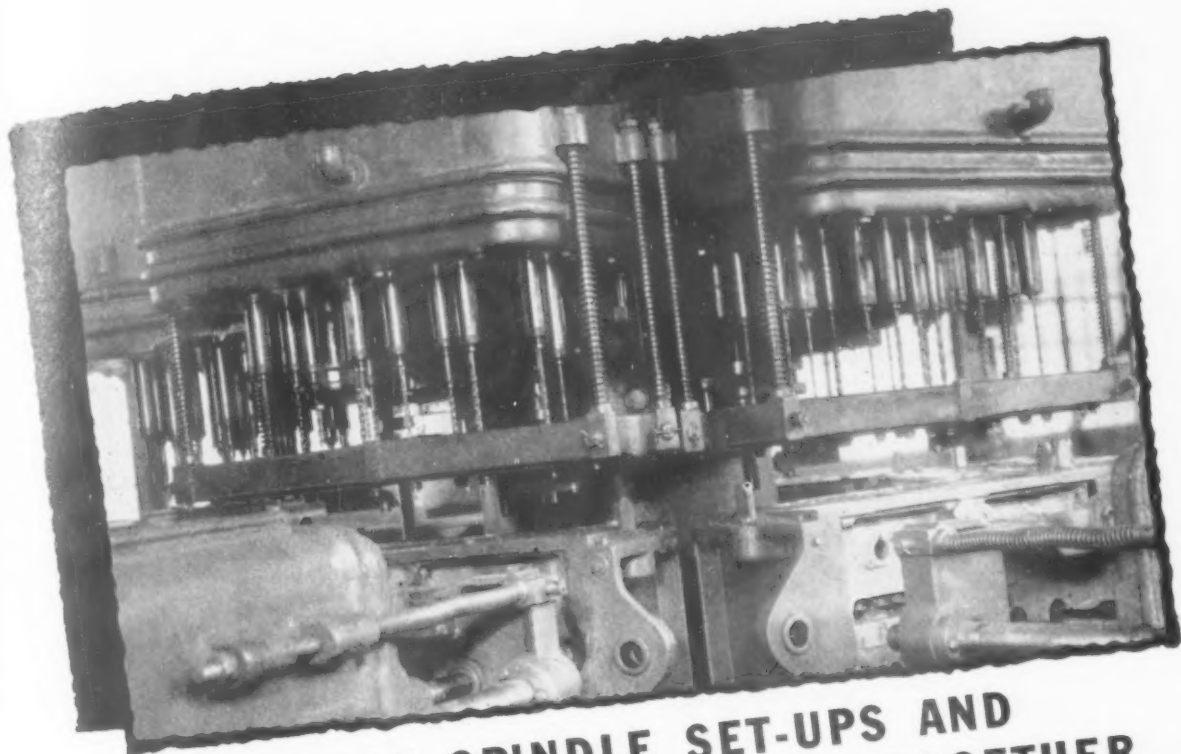
Write for circular.



**THE PRODUCTO  
MACHINE COMPANY**

990 HOUSATONIC AVE., BRIDGEPORT, CONN.  
3017 MEDBURY DETROIT, MICHIGAN



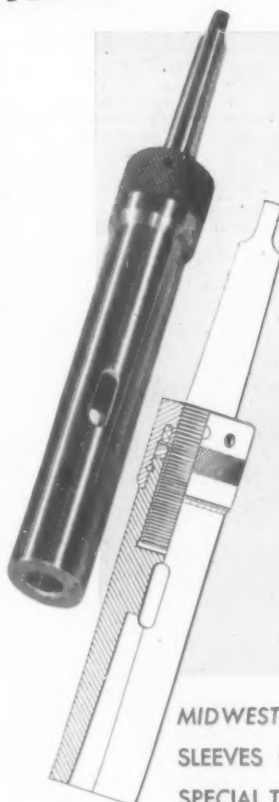


## MULTIPLE SPINDLE SET-UPS AND HEADACHES OFTEN GO TOGETHER

Misaligned tools, excessive set-up time, inexperienced help and complicated adjusting mechanisms on tool holders or holders that do not provide accurate micrometer adjustments—these are some of the headaches which often accompany multiple spindle set-ups. They are obstacles to securing accurate work and maximum production.

Midwest Adjustable Extension Tool Holders were designed for multiple spindle production jobs. They provide a simple to operate, yet a micrometer accurate adjustment to compensate for unequal tool wear and for variations in tool length. The adjustable feature reduces set-up time and makes the axial position of all the tools on the job accurate. With these holders it is possible to drill, tap, counterbore or ream to various depths or use tools of unequal lengths.

- ADJUSTMENTS CAN BE MADE IN STEPS OF .001 OF AN INCH.
- OPERATOR CAN MAKE ADJUSTMENTS BY HAND—NO TOOLS NEEDED.
- SET-UP TIME IS REDUCED.
- DESIGN IS SIMPLE, CONSTRUCTION RUGGED, ALIGNMENT ACCURATE.



### HERE'S HOW THEY WORK

Midwest holders are provided with an extremely accurate, ground fit between the sleeve and the shank. A knurled, graduated collar which controls the adjustment is located at the top of the sleeve. A key fixed in the sleeve with a sliding fit to a keyway in the shank provide a positive drive.

Micrometer, longitudinal adjustment steps of .001 of an inch are made by turning the collar one space on the bevelled edge, graduated scale. The collar holds firmly at all positions of the scale. There are no screws or locknuts to give trouble and, without tools of any kind, the operator can easily make the adjustment by hand.

MIDWEST PRODUCTS INCLUDE—MILLING CUTTERS • SLEEVES • COUNTERBORES • END MILLS • REAMERS • SPECIAL TOOLS • FORM TOOLS • CARBIDE TIPPED TOOLS • ADJUSTABLE HOLDERS.



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2364 W. Jefferson Ave. Detroit 16, Mich.

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# HANDY ANDY

## Says—

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

AT time of writing, the invasion is in its initial stages, augurs successful if sanguinary conclusion. And, because of its dramatic appeal, I am tempted to write about it. Yet, what words of mine can unloose the icy hand of dread from the heart of the mother who bides a fateful message, or assuage the poignant ache of those who have received it? What can I say that hasn't been said, or that won't be said, by the foremost writers of our time?

For here is another act in a drama that, in its stark intensity and in its effect on human destiny, is to be exceeded only by cosmic or geologic cataclysms. And, except for local, surface disturbances, such have not been witnessed by living man. No, this is a plot that would tax the pen of a Shakespeare or a Dickens, masters alike of the gamut of human emotions. As for me, I can only say as the man on the street: "Well, it's on." And a bystander answers, "Yeh, it's on." The eloquence of simple words.

Fortunately for all concerned, G. I. Joe prefers to recall the lighter diver-

sions of war rather than its horrors. Like a cousin of mine, Tore Nelson, now in the thick of it "over there". During training, his company was alternately advancing and falling prone in a mock skirmish. As he lay, flattened, he heard an ominous bzzzz, followed by a sharp sting toward the posterior. Dark suspicion flashed to mind! In realistic simulation of battle conditions, he had previously crawled under a low ceiling of whizzing machine gun bullets, so, in angry protest: "Hey, you dampfools, you're shooting too low and I'm hit!"

Then, right under his nose, the answer! With a yell, echoed by his scattering companions, he leaped to his feet and streaked for the outraged sergeant. "Get back, you dumbwit!" the non-com roared, then, stung to sudden realization as Tore raced past, he, too, beat a retreat. Tore had dropped down over a nest of ground hornets!

Then there's my nephew, Cpl. Wesley Rylander, a born naturalist who spends his spare time investigating the flora and fauna around the encamp-

ments. Down South, he became intrigued by a beautifully banded snake. It looked gentle and harmless until closer inspection revealed the sinister pits below the eyes that branded it as venomous. And how! It was a coral snake.

Another cousin—Marine Sgt. Godfrey Walden—ran into a nest of varmint down in the Solomons, only the "stinger" was a shell that missed having his number by a digit. He's rarin' to go back as soon as mended.

Well, here I've gone and written about the war after all! Seems you can't get away from it, even on the home front. In this connection, we tool engineers are in for a fight for self preservation, the enemy (to use that term) being a over zealous fringe in the Administration. And here, must be included minorities in the Army and Navy.

To be specific, there is pending legislation in various states (passed in two) restricting the term "engineer" to those with college degrees. With reservations, I'm strongly for the college graduate, the reservation being that an engineering degree doesn't make an engineer any more than the lack of it implies that a man isn't one if otherwise qualified.

Archimedes, who laid down enduring principles of engineering, was largely self trained, as was Leonardo da Vinci, perhaps the most versatile of them all. So was C. E. Johansson, who engineered the micro-inch, and Charles

(Concluded on page 196)

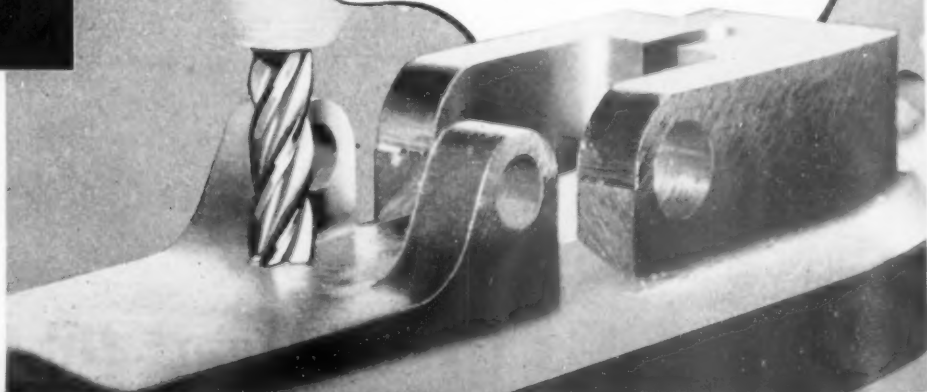


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**THE WELDON TOOL CO.** *Cleveland 4, Ohio*  
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—HANDY ANDY SAYS—

(Concluded from page 194)

Edison, inventive giant of our age. Highly educated, these men, but not college graduates. What college could have trained them in the things in which they were the creative leaders in sciences that were things of the future in college curricula? One might as well try to teach Einstein relativity!

Henry Ford is not a college graduate, nor was Walter Chrysler; their degrees have been in recognition of contributions to engineering, invention and industry. Neither is Chas. Sorensen, nor Wm. (Lt. Gen.) Knudsen, and so on ad infinitum in our roster of industrial giants. Yet, how many college graduates have achieved their eminence in the engineering world?

While a minority in our own profession are college trained, the most have come up the hard way. It had to be that way, because we preceded the degree. No courses in tool engineering had been established, in any college, until long after our advent in the scheme of mass production. Hence, the average engineering graduate, although broadly trained and steeped in theory, was utterly unequipped to evolve any but the most elementary tools or methods. He just had to get down to "basic training", and even then he couldn't win his bars, so to say, unless he had the requisites of mechanical ingenuity and quick inventive ability. What holds true for tool engineers applies to others, welding engineers among them. Sure, there is one college teaching the science of welding, just as a few institutes have latterly included courses in tool engineering. But here, too, the welding engineer preceded the degree; he developed the art and was its first instructor. Maybe we'll have reinforcements, eh?

Of course, the saner elements in the Administration, and in the Army and Navy, are deeply conscious and as deeply appreciative of the role played by the tool engineers in the prosecution of this war. We've gotten production—more than the combined enemy forces could cope with!—simply because a legion of practically trained tool engineers, with "know-how", evolved the tools and methods.

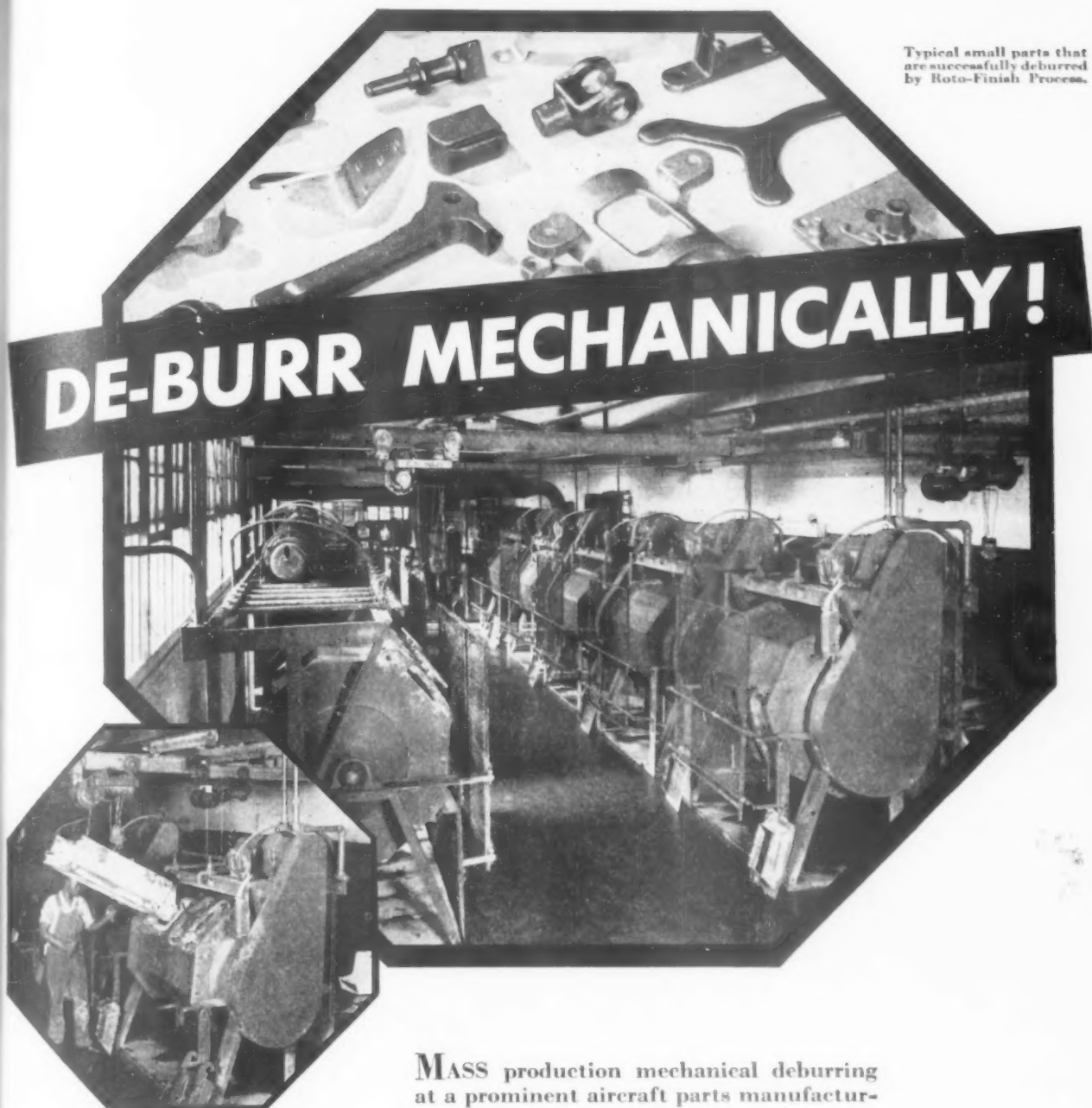
The story of America's conversion from peacetime to wartime production is long since an epic saga. From an incipient trickle, the goods of war swelled and rolled on in a mighty torrent without which this nation could not have so quickly turned the tide of battle, let alone supplying our Allies with the weapons and materials for victory. We, the tool engineers, practical men with the plus of engineering training, were among the fountain heads in that stream. Lest they forget—if they ever knew—let's impress that fact on our solons.

All right, so much for that, but only for the nonce. For this is an opening barrage in a battle for our professional and economic existence, and it's going to be fought if I have to fight it alone. But, you're going to rally behind me. Don't forget!

THE END



Typical small parts that are successfully deburred by Roto-Finish Process.



Loading parts and Roto-Finish Grinding Chips into a Roto-Finish Machine. The larger picture shows the Roto-Finish department—a Defense Plant Corporation installation that saves the work of many hands and boosts production tremendously.

**MASS** production mechanical deburring at a prominent aircraft parts manufacturing plant in Detroit proved so satisfactory that today an entire Roto-Finish department has been developed.

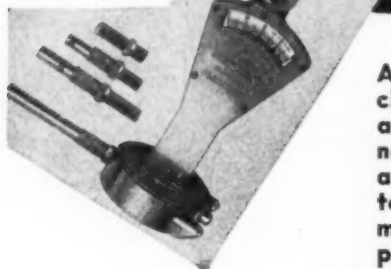
The speed-up in production and amazing savings are typical of the advantages of Roto-Finish in hundreds of war plants. Working equally well on large and small parts of steel, brass, aluminum, magnesium, stainless and nickel steels, it is natural that Roto-Finish offers tremendous possibilities for peacetime production, too!

For your reconversion planning—be sure to have full details about this new production technique. Send for literature—and we'll be glad to receive sample parts for processing.



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Easily  
Handled,  
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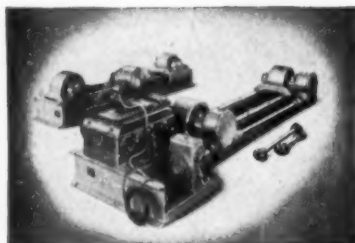
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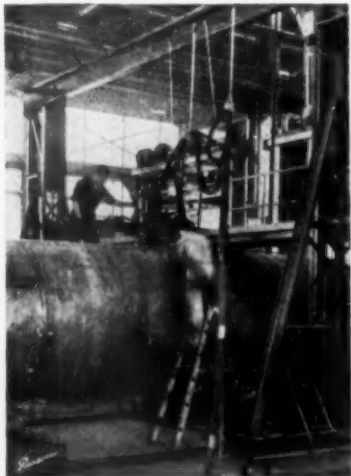
It can be set to any required size direct from Johansson Gage Blocks or Master Ring.

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## CARBIDE TOOLS

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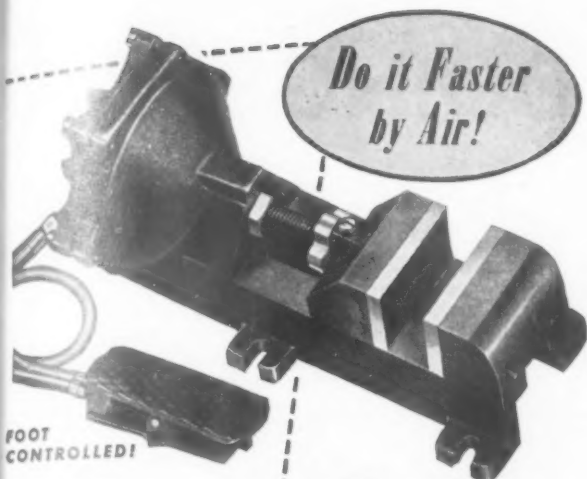


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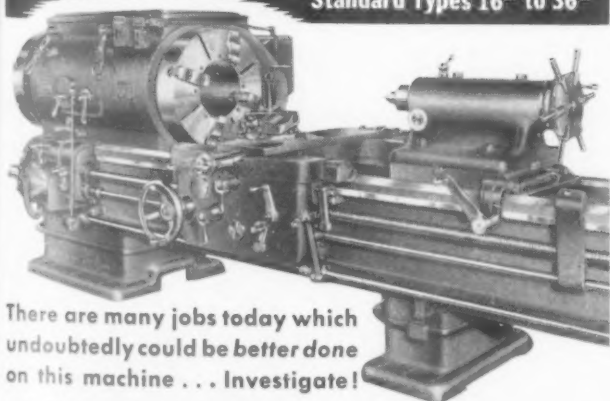
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Save Man-Power and Materials!

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Standard Types 16" to 36"



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### RED-E STYLE K Shaper Tool

DESIGNED FOR SMOOTH WORK

Why use a lathe tool for a shaper when you can get a Red-E Shaper Tool that will take perfectly smooth, heavy cuts with absolutely no chatter?

This is a single-purpose tool with the old goose-neck principle. The cutting point is on the line of deflection and any springing of the tool it takes away from the work and not into it deeper.

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● For application blanks and information pertaining to membership in the American Society of Tool Engineers, address the Secretary's office, 2567 West Grand Boulevard, Detroit 8, Michigan.

● Senior initiation fee is five dollars. Dues eight dollars per year for senior grade membership and five dollars per year for junior grade membership. Junior initiation fee is two dollars.

**Atlanta:** R. E. Ferris of Continental Machines, Inc., was principal speaker at the June 7 meeting held at the Ansley Hotel. Approximately 125 members and guests turned out to hear Mr. Ferris talk on "Precision Measurements in Industry." Movies also were presented on the subject and were followed by a demonstration and explanation of a complete set of instruments including gage blocks, master flat, line bar, and monochromatic light.

**Binghamton:** Technical speaker at the June 7 meeting held at Hotel Sherwood, Greene, N. Y. was Malcomb F. Judkins, chief engineer for Firth-Sterling Steel Co. He spoke on sintered carbide tools and carbide insert dies. The talk was accompanied by a film giving a thorough description of the application of carbides. Seventy-eight members attended.

**Central Pennsylvania:** J. R. McGrath, local representative, and John Kinsey, export manager, both of Micromatic Hone Corp., presented a two-part movie at the May 11 meeting held at the York Engineering Society. The talk covered the technical and practical aspects of the honing process, and its relation to various other machining processes. Attendance was 36 members and guests.

**Dayton:** Instead of the usual dinner meeting, the chapter held a quiz program on "Tooling Problems" at the June 12 meeting.

John K. Matthews served as chief "expert", assisted by Ray F. Bleicher, Howard T. Walther, and C. E. Mon-



Executive officers and committee chairmen of the Baltimore chapter met May 11 in special session to chart membership drive. They are (left to right): W. L. Reynolds, Fred Bruggman, G. Steiner, J. O'Connor, Edward Kuzma, Stuart H. McCaughey, Charles Moyer, John Talbot, W. Daryl Winger, and Howard C. Will.

nier. The "experts" answered questions submitted by members before the meeting. The meeting was the last indoor session until Fall.

**Detroit:** Approximately 300 members and guests attended the June 8 meeting at the Hotel Fort Shelby to view a government movie, "Battle of the Beaches," a film depicting various amphibious operations.

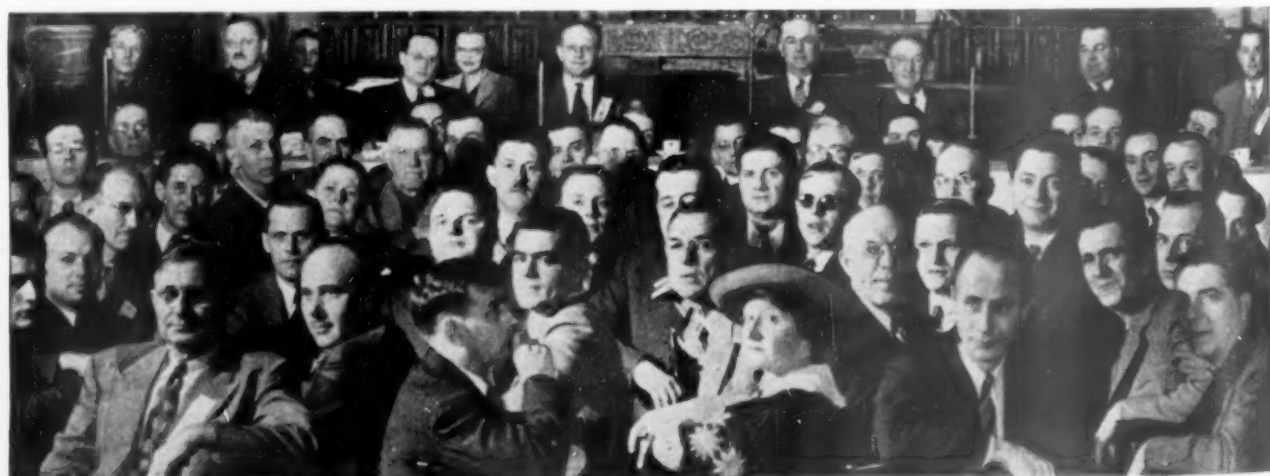
Capt. W. S. Rigby of the Detroit Ordnance District substituted as technical speaker for Lieut.-Col. Jarrett who was unable to make an appearance.

He spoke on "Captured Enemy Material".

Guests included Brigadier G. M. Ross, and Lieut.-Col. A. V. Golding, of the British Army, and Lieut.-Col. Robert J. Ikes and Maj. S. H. Larcomb from the Detroit Ordnance District.

**Erie:** W. S. (Bill) Jack, of Jack and Heintz, Cleveland, addressed 750 members and guests at the April 4 meeting. He scored the government's taxation and renegotiation policies and said that both government and industry must

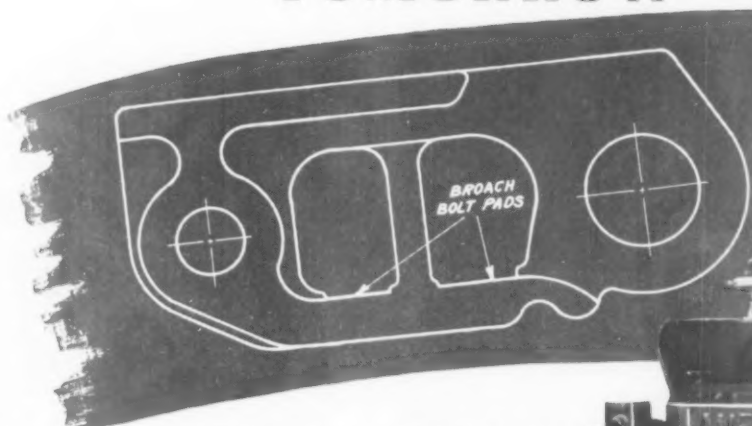
(Continued on page 202)



Shown above is part of the large crowd that turned out to hear Ervin (Cannonball) Baker former automobile and motorcycle racer, at the May 4 Meeting of the Indianapolis chapter at the Lincoln Hotel.

# BROACHING BY PROVEN

on Tanks Today . . .  
Ready for Tractors  
TOMORROW



War's demands necessitated an increase in the speed of precision production. Broaching met the challenge successfully. Forward-looking manufacturers will plan to cut costs, use manpower efficiently in peacetime by broaching—the *American* way.

Here is a typical example: Increased output, uniform accuracy, and excellent finish are obtained by broaching the internal bolt pads in tank track connector links. An *American* T-15-36 3-way type machine, provided with a manual positioning device to prevent loading a part of the wrong hand, does the work quickly, economically.

Let *American's* complete broaching service—machines, tools, and engineering—help you in war production or in postwar planning. Phone, wire, or write for complete information.



Enlist the services of an expert broach manufacturer when broaching tools are to be designed. Obtain the benefit of his experience.

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STANDARD MACHINE TOOL CO.  
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provide jobs for returning servicemen.

A "Ladies Night" meeting was held June 6 at the Masonic Temple Banquet Hall. The program included a dinner, remarks by John C. Wilcox, chapter chairman; an address by N. A. Carlson, vice-president and general manager of Erie Meter Systems, on "What About Tomorrow"; a drawing for door prizes, and dancing.

**Fairfield County:** M. W. Reid, supervisor of tools, jigs, and fixtures for General Electric Company at Bridgeport, Conn., was principal technical speaker at the June 7 meeting.

Also on the program was a report by V. V. Koodroff, supervisor of tools and equipment for the United Aircraft Corp., who told of a conversation with Maj. Gregory Boyington, U. S. Marine Corps, concerning his downing of four Jap Zeros in one day. The meeting was the last one for the summer, the next session being in October.

**Fond du Lac:** Termination of war contracts was discussed at the June 9 meeting held at the Beaumont Hotel in Green Bay, by A. F. Gehrke, district manager of the Smaller War Plants corporation, and A. J. Freese of the Chicago regional office of the S. W.-P. C. It was pointed out that all manufacturers should keep careful records of inventory and status of work and that all data should be presented to the contracting office for settlement as soon as orders for termination of work



Ray H. Morris, former national president, administers oath to new Buffalo-Niagara chapter officers. Left to right: Morris; H. Rose, chairman; J. Bomb, 1st vice-chairman; M. Kotarba, 2nd vice-chairman; W. Sossong, secretary, and A. C. Dayman, treasurer.

are received. It was also explained that various W. P. B. offices will hold meetings and schools of instruction on contract termination in the near future.

Also on the program was a talk by R. B. Seger of the Lindberg Engineering Co., who talked on "Heat Treating Hints." He explained how various difficulties could be overcome, especially on unusual shapes and types of material.

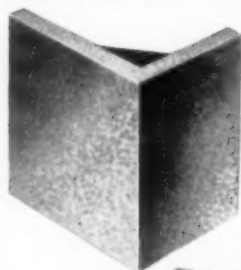
**Fort Wayne:** E. George Marshall, process tool engineer for Bowser, Inc., spoke on "Practical Die Design and

Die Making" at the June 14 meeting held at the Chamber of Commerce Building.

Also on the program was a talk by Harold Mannoser, secretary of the Tokheim Pump Co., who discussed post-war projects as visualized by the Civil Affairs Committee of the local chamber of commerce.

**Golden Gate:** Technical speaker at the June 13 meeting held at the Engineers' Club, was F. A. Swanson, Engineer for Barnes Drill Company. He talked (Continued on page 204)

## VITAL FOR SUCCESSFUL INSPECTION LOMBARD ANGLE PLATES



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Careful scraping of worn surface plates puts them back into perfect condition for added years of service. Prompt service assured.



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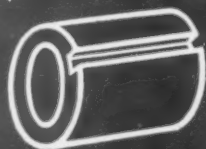
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~~Broaching machine - 3000 pieces~~

Nichols Miller - 9000 pieces

**M**ILLING a wrench slot in these rings was originally treated as a broaching operation until the job was put on a Nichols Miller. The work was simplified, and the output was increased from 3,000 pieces to 9,000 every twenty-four hours!

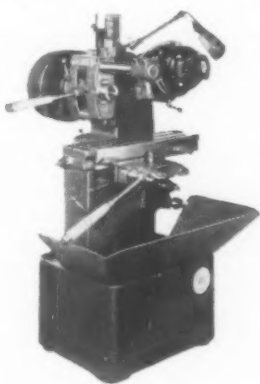
This is not an unusual situation for the Nichols Miller. It is often called upon to do the work of precision boring machines, lathes and grinders more economically.

That's why you can see Nichols Millers everywhere, performing many different high-speed machining operations under the same roof—on production lines, in toolrooms and laboratories. One is cutting hexagonal nuts, another is being used for wet grinding. Still another is doing precision turn-

ing in place of a lathe, and so on through a wide range of milling, boring, turning and facing applications—to tolerances in "tenths."

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## THE NICHOLS MILLER

*"The Miller That Comes to the Work"*

SOLE DISTRIBUTORS: NICHOLS-MORRIS CORP., 46 CHURCH STREET, NEW YORK 7, N. Y.

on "The History of Honing." He supplemented his talk with a moving picture.

**Hamilton:** The third annual field day was held June 17 at the Dundas Golf Club, Dundas, Ont. A \$50 Victory Bond was awarded as grand prize, and other prizes were given for winners at golf and horseshoes.

**Hartford:** Tell Berna, general manager of the Machine Tool Builders Association was main speaker at the June 5 meeting, held at the Hotel Bond. He talked on the production achievements of aircraft, machine, machine tool, and ball bearing manufacturers. He pointed out that management skill will be needed to achieve postwar prosperity.

Also on the program was a talk by Gene Sarazen, professional golfer, who talked on his experiences while on tours. Approximately 450 members, manufacturing executives, and engineering associates attended the meeting.

**Houston:** C. K. Worthen, of the Norton Company, was technical speaker at the May 16 meeting, held at the Houston Country Club. His talk on "Grinding Wheels and Their Application" was accompanied by a sound and color film.

Also on the program was showing of a movie entitled "The Plastic Age" shown through the courtesy of Modern Plastics, Inc. About 150 members



Dayton Chapter 1944-45 officers and committee chairmen (left to right): Walter Olt, chairman; George Bollman, secretary; Frank J. Wilhelm, membership; George Goodwin, constitution and by-laws; George Tillotson, 1st vice-chairman; Walter Wise, standards; Adam Lensch, treasurer; Ora W. Peters, publicity; Patsy Difloure, editorial; William F. Hart, industrial relations; Paul Snyder, educational; and J. D. Blair, entertainment.

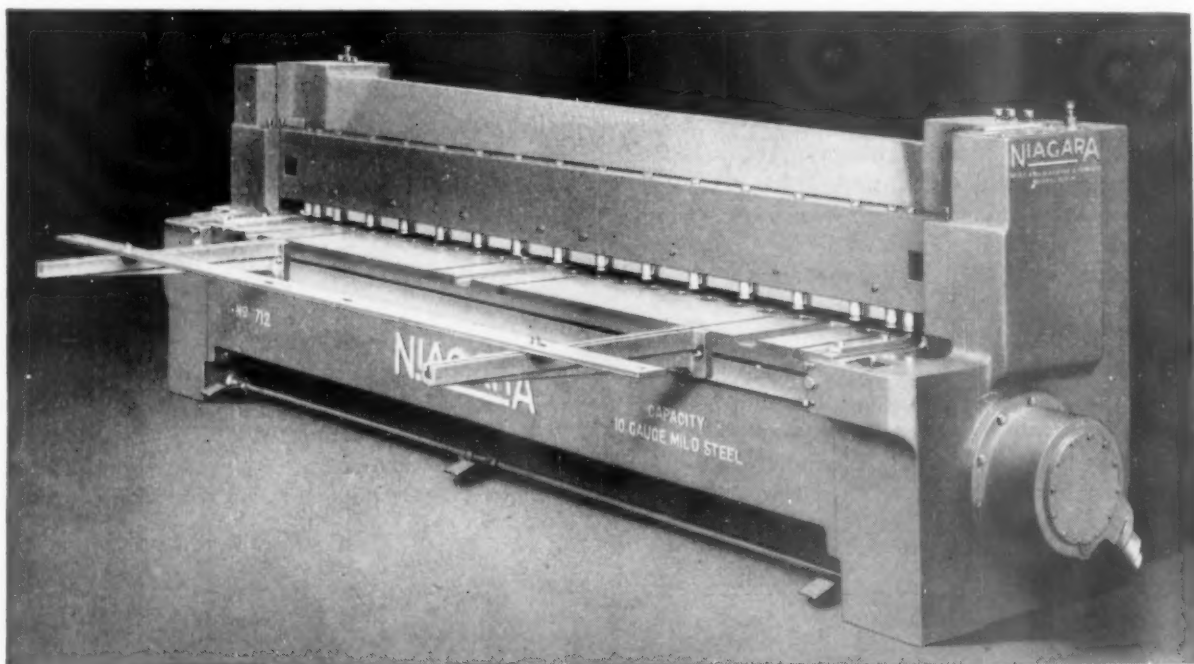
and guests attended the meeting.

**Indianapolis:** The 1944 Spring picnic was held June 3 at Lake Shore Country Club. The program included baseball, horseshoes, and golf. Dinner was served in the evening and more than 100 prizes were distributed.

**Kansas City:** A summer party was held June 6 at the Hillcrest Country Club.

**St. Louis:** At the June 1 meeting, held at Hotel Melborne, G. B. Berlien, chief metallurgist for the Lindberg Steel Treating Co., presented a paper on heat treating problems. He also showed a color film illustrating various heat treating operations. Although this was the last technical meeting until September, activities will be carried on during the summer months.

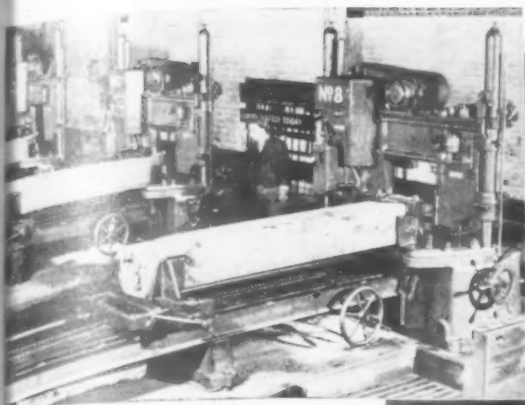
(Continued on page 206)



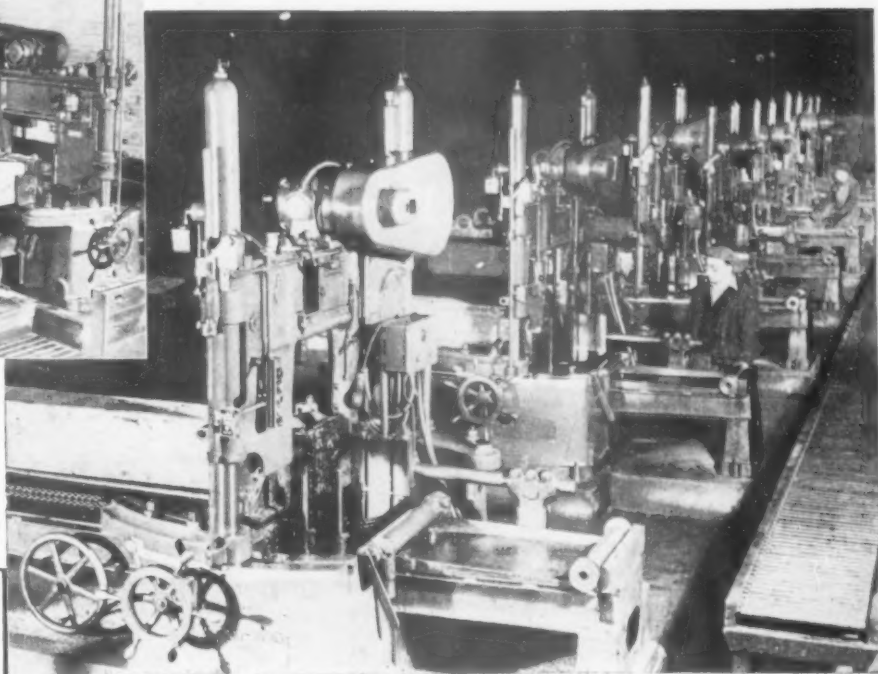
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Shear knives available for cutting alloy and special steels. Let us know what you desire to cut. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory regrinding service by the same skilled men who grind new Niagara knives.

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Part of the row of No. 18 MARVEL Giant Hydraulic Hack Saws used to crop and cut-off test slices for metallurgical tests for large billets of tough alloy steels.



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When a greatly expanded steel plant, near Canton, Ohio faced the problem of cropping and cutting-off test samples from large alloy billets, in **wartime** quantities and at wartime speed, they checked the performance of all types of cutting-off equipment in all their other company plants, and selected MARVEL No. 18 Giant Hydraulic Hack Saws for this "tough" job.

Now this row of twelve MARVEL No. 18 Hydraulics shown above, operating continuously, 24 hours a day on tough alloy billets of from 14" to 16" cross section, handle this tremendous, heavy duty cutting-off job without a hitch and with a minimum of man hours—only four operators per shift.

When you have a cutting-off problem your most logical first step is to check with your local MARVEL Sawing Engineer for recommendations of methods and equipment.

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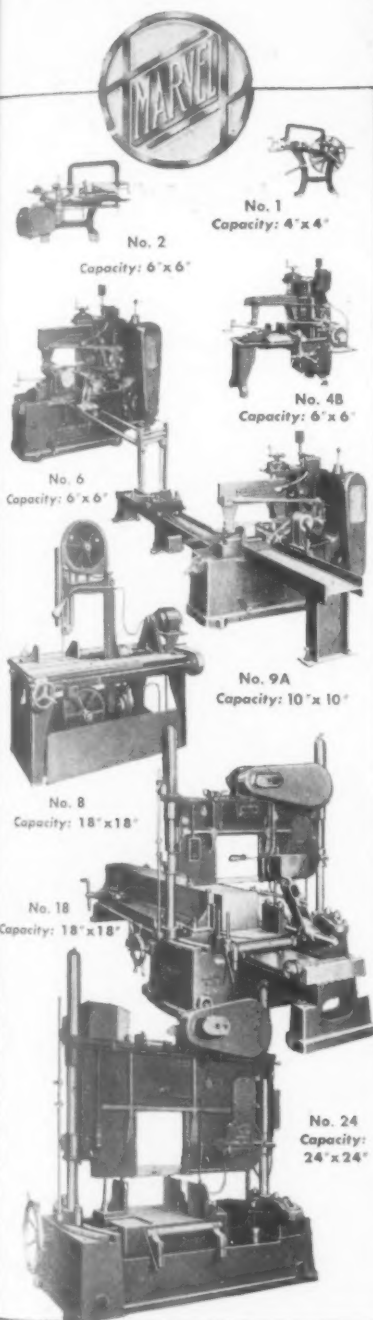
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# MARVEL SAWS







**Lakehead:** Frank Tanner, representing A. C. Wickman, Ltd. of Canada, presented a talk on "Cemented Carbide and Powder Metallurgy" at the June 1 meeting at Legion Hall, Port Arthur. He also showed a film illustrating fabrication of cemented carbide from its formation to application in cutting, pressing, and other uses.

**Los Angeles:** F. A. Swanson, sales manager of Barnes Drill Co., was technical speaker at the June meeting. He talked on the history of honing and how

it has affected mass production as a replacement for grinding. His talk was accompanied by several films showing various honing operations and equipment.

**Louisville:** A. Allen Bates, manager of the Chemical and Metallurgical department of the Westinghouse Electric and Manufacturing Co. East Pittsburgh plant, spoke on "Industry and Industrial Development in South America" at the June 13 meeting. He based his talk on observations made on a re-

Douglas D. Burnside, national president, addresses the May 4 meeting of the Potomac chapter at the Mayflower Hotel.

cent trip to that continent. He also showed maps illustrating political boundaries, relief, density of population, and annual rainfall.

**Milwaukee:** An informal dinner dance was held June 24 at the Pfister Hotel. The program included presentation of attendance prizes.

(Continued on page 208)



A. B. Lindstrom, chapter chairman, demonstrates gear design technique to Capt. B. F. Linsley at Engineer's War Conference sponsored by Hartford Chapter.

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ON IDEAS!**

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No matter what products you are planning to make for the post-war era, from heavy machinery to household utility articles, there are component parts which can be made better, faster, cheaper—with OH 38.

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Internal Grinding

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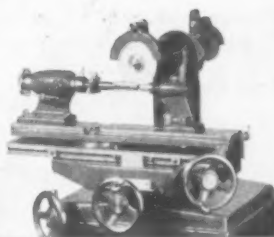
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On a production line, as well as in tool maintenance a wide range of work can be done on the Rotorex such as: cylindrical and internal grinding as well as sharpening of all kinds of tools to the closest of tolerances.

Easy interchangeable attachments for faster set ups, selective speed range from 3000 to 6000 rpm are outstanding features.

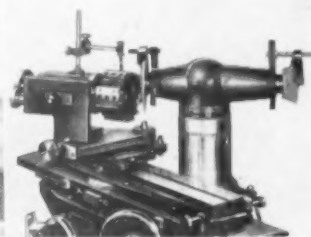
Simplicity of design and operation makes it possible for even inexperienced workers to operate with the highest efficiency after a short period of training.



Tap Grinding Attachment



Sharpening Helical Cutter

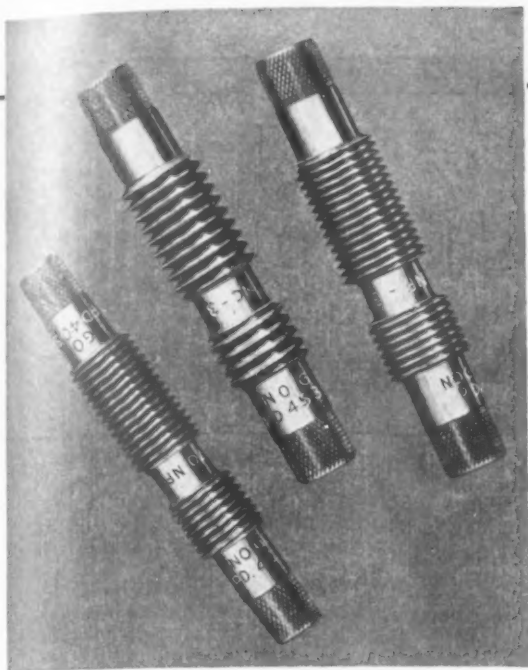


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Save time by eliminating the wringing together of "Jo" blocks to obtain a correct size. Choose the proper size Thred-Master, select the right wires, and you are ready to go.

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All Thred-Masters conform to N.S.T.C. standards (class 2 and 3 fits) and consist of both Go and No Go members. Their sizes range from 10-32 NF to 1"-8 NC inclusive. They are made to "W" tolerance accuracy on pitch diameter, lead, and thread angle, and are delivered in sets of twelve designated as National Coarse or National Fine.

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## UNSKILLED MEN or WOMEN

can turn out **FAST, ACCURATE TAPPING** for you

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**Ettco-Emrick**  
FOOT-OPERATED  
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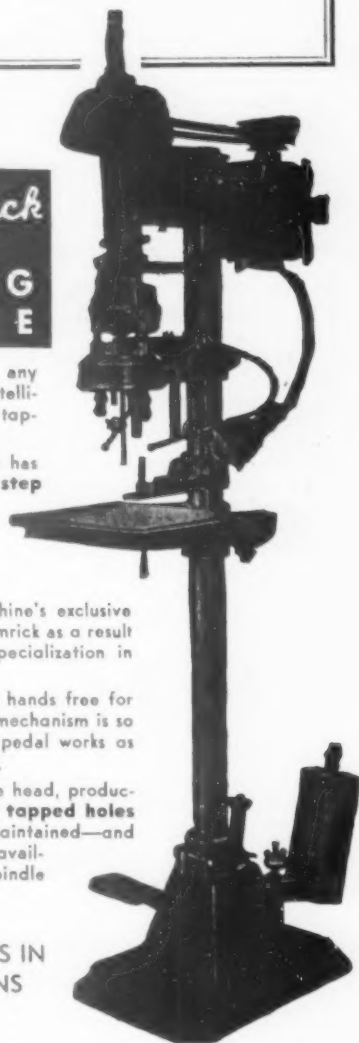
With only brief instruction, any man or woman of ordinary intelligence can do a fast, accurate tapping job on this machine.

Here's why. All the operator has to do is feed the work and step on the pedal. The machine does the actual tapping independently of the operator.

The necessary sensitivity, accuracy and tapping speed are all provided by the machine's exclusive features, perfected by Ettco-Emrick as a result of more than 25 years of specialization in machine tapping.

Foot operation leaves both hands free for faster feeding and the entire mechanism is so delicately balanced that the pedal works as easily as a car's accelerator.

With the standard 2-spindle head, production up to **2400 accurately tapped holes per hour** can readily be maintained—and up to **12,000 per hour** with available Ettco-Emrick Multiple Spindle Heads.



GET FULL DETAILS IN  
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BULLETIN No. 4

Covers the Tapping Machine

BULLETIN No. 3

Covers the Multiple Heads

Copies mailed to you on request.  
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### IMPORTANT

Our recommendations as to correct taps, parts handling methods and work holders for specific jobs are always available to Ettco-Emrick tapping equipment users.

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The Famous **Ettco-Emrick** DRILL CHUCKS • TAP HOLDING CHUCKS  
TAPPING ATTACHMENTS • TAPPING MACHINES  
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS  
Unexcelled for Design, Materials and Workmanship

**Seattle:** Arthur Burgan, representing American Broach and Machine Co., was technical speaker at the May 9 meeting, held at Gowman Hotel. His talk, illustrated with slides, covered fundamentals of broaching tools and their design.

Also on the technical program was a talk by Eugene Dawson of the Dawson Machinery Co. He talked on the increasing use of dial indicators, and presented a film showing construction, operation, and application of dial indicators in mass production procedures.

**Syracuse:** Activities have been suspended for the summer, and the next regular meeting will be held Sept. 9, when a clambake will open the season. During the summer months, informal table talks will be held to prepare for the semi-annual national A. S. T. E. convention at Syracuse in October.

**Toledo:** Henry D. McLarty, director of research, McLarty Business Films, presented a paper on "Ultra High Speed Motion Pictures and Their Application to Industry and Research" at the May meeting.

George B. Webber, of the Webber Gage Block Co., staged a demonstration of the use of angle gage blocks. Approximately 130 members and guests attended.

**Toronto:** Approximately 150 persons attended the May 12 meeting to hear A. A. Cambria, chief design engineer,

## EDITOR

Wanted for American Society  
of Tool Engineers Hand book

For information, write  
E. E. Ernst, Publications Committee,  
American Society of Tool Engineers,  
2567 W. Grand Blvd., Detroit 8, Michigan

Lapointe Machine Tool Co., speak on "Broaching." His talk was illustrated by slides. The National Film Board presented a short movie on radio's part in the war.

**Tri-Cities:** The annual Summer stag was held June 10 at Olive Singers Home, Moline, Ill. Special entertainment was provided.

**Twin Cities:** Speaker at the May 17 meeting was John W. Kinsey, of the Micromatic Hone Corp. He traced the history of honing from the first world war to the present time, and discussed the use of honing for stock removal, truing up machine surfaces, and producing fine surface finishes. He also showed two movies, "The Hone Abrading Process" and "More Than a Machine."

**Twin States:** A field day was held at Rockingham Country Club June 17. The sports program included Scotch golf, horseshoes, and softball. Door prizes and golf prizes were awarded.

**Wichita:** A. R. Wallis, representing the Kansas City plant of North American Aviation, Inc., was technical speaker at the June 13 meeting, held at Droll's English Grill. He discussed "Carbide Milling Practice" from the standpoint of design, and dealt with individual problems and solutions. Approximately sixty members and guests attended the meeting.

**Windsor:** Coffee speaker at the May 9 meeting, held at the Prince Edward Hotel, was Bruce Moore, who gave an explanation of the procedure and pro-

(Continued on page 212)



### A LEADING AIRCRAFT MANUFACTURER FINDS MANY USES FOR THIS TIME-SAVING TOOL

"Magna-Sines are used in layout, checking, inspection, light milling and light drilling as well as grinding. The milling and drilling operations are generally done before the permanent jigs and fixtures are built or when only a few pieces are to be made."

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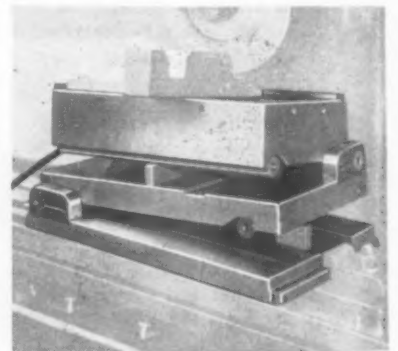
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OF YOUR **MAGNA-SINE'S VERSATILITY ?**

There are many places in every shop where the Magna-Sine will save many hours and many dollars. Use it for milling . . . drilling . . . boring . . . grinding . . . or any light operation where the work must be held securely and accurately at an angle.

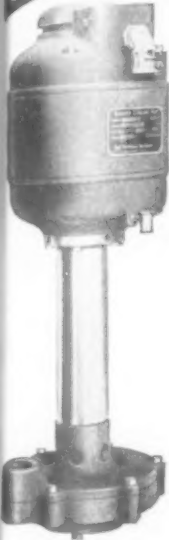
The Magna-Sine will hold any magnetic material at any single or compound angle accurately and securely, but without distortion. It can be set to a required angle quickly, usually in a matter of seconds. The work is held firmly at the turn of a switch and is released with equal ease.

Find out how you can save time and money on almost any angular operation. Write for complete information on the Magna-Sine.



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## MINIMUM MAINTENANCE GUSHER COOLANT PUMPS

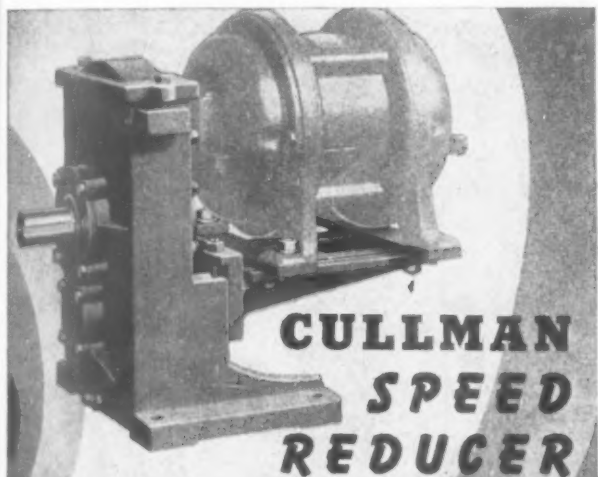
Plant records of some of the country's largest factories show that Gusher Coolant Pumps require minimum maintenance. This is due to the simple design, with few parts and no bearings within pump itself, elimination of all packing nuts, no metal-to-metal contact, no relief valves. The result is less friction, less wear, longer life, minimum maintenance. From a dribble to 200 g.p.m., with no leakage — 1/30 to 2 H.P., there is a Gusher model and type for your special needs.

Model TL-7320.

See Section 2 of new catalog, indexed for quick reference.  
Gusher Pumps Patented and Patents Pending.

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The "Gusher" — A Modern Pump for Modern Machine Tools



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The high speed of electric motors can be stepped down economically with Cullman Speed Reducers to meet the requirements of the slower machine operations. They are made in single, double or quadruple reduction types for motors from 1/8 to 15 H.P. Ratio 1.65 to 1 to 1015 to 1.

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Protection of highly-stressed parts against wear, impact, fatigue is an important point to check in the specifications of machines you buy. Over 90 leading machine-tool builders guard against costly failures with parts of Ampco Metal — an alloy of the aluminum bronze class, with controlled physical properties that give it several times the life of ordinary bronzes. Be sure you get it on your new machines; insist that replacement parts for your older machines be made of durable Ampco. Write for "File 41—Engineering Data Sheets."



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Has Removable, High-Speed  
Cutter Blade for Long Life  
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Cutter blade can be utilized almost its entire length. Cutting edge always has a fixed position eliminating adjustment of machine stops after grinding. Pilot drilled and tapped to hold different sizes



of bushings. Many other exclusive features not found in ordinary Counterbore and Spot Facer tools. Made in 41 standard sizes. Write for circular on details.

**FEATURES**—Removable Cutter • Maximum Cutter life • Cutting edge fixed • Chip clearance in bar • Permanent chip clearance • Cone nut centers cutter • Cutter replaceable • Provision for pilot bushings.

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DIVISION OF J. M. NASH COMPANY

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## — A. S. T. E. DOINGS —

cessing of synthetic rubber

Technical speaker was W. Green, of Fostoria Pressed Steel Products, who talked on "Infra-Red Application in Industry." He also showed slides of various infra-red installations.

**Worcester:** The last meeting of the season was held June 6 at Putnam and Thurston's with 70 persons present. Lieut. John B. Nash, recently returned from combat duty in the South Pacific, addressed the meeting. He was followed by Lieut. Clark Nichols, who told of his experiences in the European combat area. Major O'Connell gave a short talk on aviation.

## July Meetings



**Atlanta:** July 16. Annual picnic. North Fulton Park.

**Dayton:** Fish Fry, Inland Gun Club.

**Los Angeles:** July 13, Scully's Cafe.

**Portland (Ore.):** July 6, Mallory Hotel. Phillip McKenna, president of Kennametals, Inc., will talk on "Carbide-Tipped Tools."

**San Diego:** July 14. Color film, "The Formica Story."

**St. Louis:** July 27. Annual Stag.

**You Save  
MAN-  
POWER**



**You  
SAVE  
METAL  
with...**



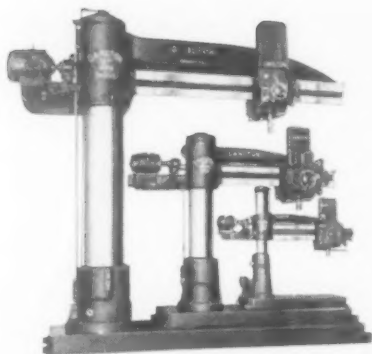
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ARC WELDING

Hobart "Simplified" Arc Welders have proven that they can take it day in and day out on production. Exclusive Remote Control, oversize four pole exciter, two-way ventilation, balanced design, and 1,000 combinations of voltage and current are only a few of the unusual features. Available for immediate delivery. Ask for details.

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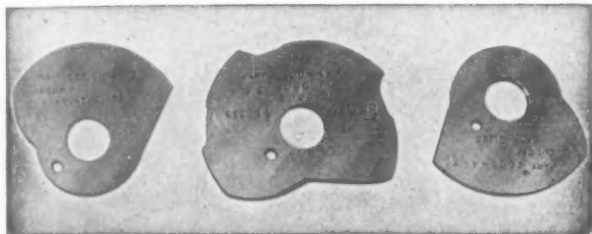
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MACHINE TOOL COMPANY

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## SCREW MACHINE CAMS

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## B & S MACHINES


Cams cut to your layout shipped within 2 to 3 days.

Set of 3 No. 00 Cams including blanks, cutting, heat treating — \$6.20 complete. Other sizes in proportion.

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# FEDERAL

## *Taperlock*

# GAGE HANDLES

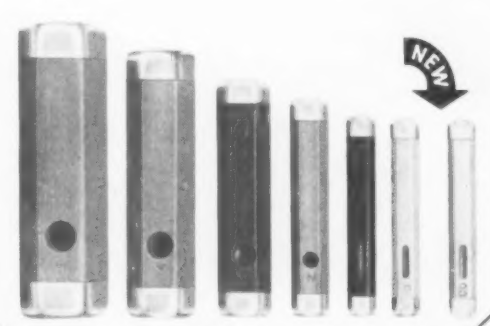
MADE of light weight plastic material, Federal Gage Handles are lighter than any metal used, even one-third lighter than aluminum. This lightness permits a most sensitive "touch" with less fatigue in long continued use; an advantage appreciated by women inspectors.

They are highly satisfactory with glass gages being so much lighter than metal handles, they reduce the danger of chipping and breakage.

Insulating properties help prevent transmission of bodily heat to gages which may affect accuracy.

Marking for identification is accomplished with the same marking tools used for metal gages. Available in 7 Sizes—00 for Small Gages, 0, 1, 2, 3, 4, and 5. In 4 Colors—Red, Yellow, Green and Black.

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## METAL SHIPPING TAGS



TAGS  
ALSO SUPPLIED  
IN HUNDREDS  
OF SHAPES AND  
SIZES—FOR EVERY  
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TAGS FURNISHED BLANK—  
COMPLETELY OR PARTIALLY  
EMBOSSED—IN A  
WIDE RANGE  
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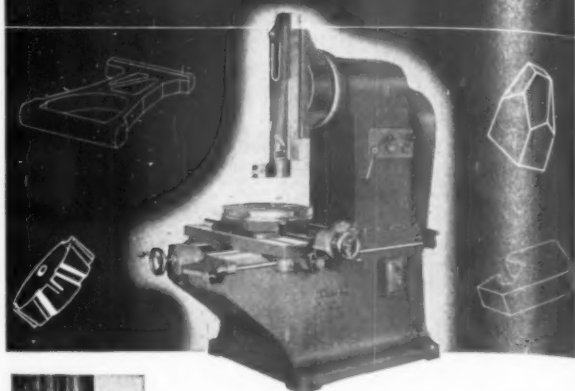
Metal shipping tags speed delivery of products by reducing or eliminating lost shipments due to illegible addressing. They withstand exposure to rain, snow, oil or grease, also, grinding and scraping in piling or handling. Write today for complete data.

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A wide range of service is assured by the Douglas Precision Slotter because of its vertical design, swiveling ram head and tool holder. Automatic circular table with independent automatic feeds in all directions gives the machine greater flexibility and a further advantage of easy mounting of work without the need of costly fixtures.

Control levers are conveniently located, permitting quick, smooth operation and better observation of work during operation.

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Made to your blueprints with precision accuracy and fine workmanship, A.C.E. special cutting tools provide long cutting life. Send us your inquiries for prompt estimates. Bulletin on request.

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## BACK OF THE BREN GUN . . . . . Brightboy



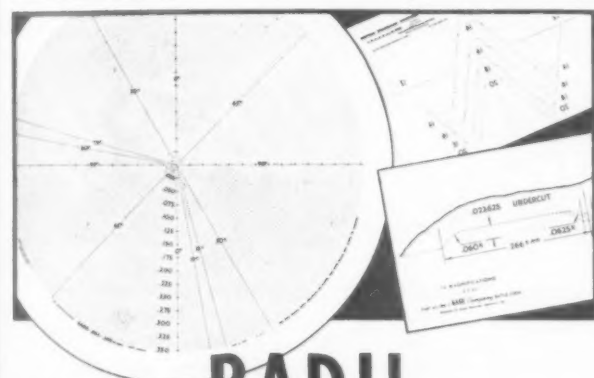
Top: Polishing and removing burrs on Bren Gun post piston. Bottom: Close-up of finishing, gun extension posts.

On many of the important parts of the precision-made Bren Gun, Brightboy's resilient rubber and abrasive combination has materially speeded production and improved quality.

Brightboy is back of the Bren Gun and hundreds of other implements of war with a new conception of precision-quality finishing and will continue to bridge the gap between the grind and the buff in peacetime production applications.

Brightboy is made in a wide variety of shapes and sizes for manual and machine work. Our Service Department or field representatives will show you how to save time—improve quality—in your abrasive finishing. Ask your dealer for prices and Applications Data.

BRIGHTBOY INDUSTRIAL DIV.,  
Weldon Roberts Rubber Co., Newark 7, N. J.



PRECISION-MADE  
NON-BREAKABLE PLASTIC

# RADII

*Charts*

## THREAD FORM AND SPECIAL OPTICAL COMPARATOR CHARTS

Prepared with highest degree of accuracy on heavy plastic free from warp or distortion. Made for every model and make of optical comparator; in use at leading plants all over the country. Moderate in cost, yet the last word in performance.

Standard radii and thread form charts of every type; specially constructed inspection screens for all comparators and all purposes.

WRITE FOR COMPLETE INFORMATION  
AND QUOTATIONS WITHOUT OBLIGATION

# GAGE

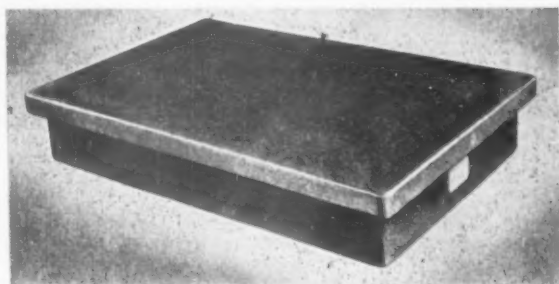
*Company* DIVISION  
BATTLE CREEK, MICHIGAN

*The final word in precision charts!*

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## HERMAN

## Precision Granite SURFACE PLATES



## Right in Your Own Plant

Let our representative call with samples of **Herman Precision Granite Surface Plates**—test them under conditions as they actually exist in your own plant. Then you will see why the roster of companies now using them reads like a page from America's "Who's Who" of distinguished businesses . . . because **Herman Precision Granite Surface Plates** are positively accurate to 1/10,000 inch — cut from granite, they are hard and smooth — non-magnetic, non-porous, non-corrosive. Wherever precision requirements are highest, there you will find **Herman Precision Granite Surface Plates**. Available in many sizes at reasonable prices. Write or wire today for descriptive folder, technical data, and sample for test in your own plant.

### A Few Famous Users of Herman Granite Surface Plates

U. S. Bureau of Standards	Allis-Chalmers
General Motors	International Harvester
Chrysler Motors	Curtiss-Wright
Ford	Crosley Radio
General Electric	Bendix
Westinghouse Electric	Bausch & Lomb

(Write for Comprehensive Report by Internationally-Known  
Technical Laboratory.)

## *The Herman Stone Co.*

1241 Leonhard Street, Dayton 4, Ohio

# • THE PASSING PARADE •

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

## THE EVER-CHANGING SCENE IN MASS MANUFACTURING

**Prof. Hugh E. Keeler**, mechanical engineering department, University of Michigan, has been appointed a member of the committee on Code for Pressure Piping of the American Standards Association. He will aid the committee in its work on design, manufacture, test, installation, and operation of pressure piping systems.

**Samuel W. Anderson**, formerly deputy vice-chairman for metals and minerals, has been appointed program vice-chairman and chairman of the requirements committee of the War Production Board. Prior to his association with WPB, Mr. Anderson was on the staff of the Aluminum and Magnesium Division of the Office of Production Management. Before entering OPM he was connected with the Suchar Process Corporation, of New York.

**R. A. McCarty**, vice-president of the Westinghouse Electric & Manufacturing Co. in charge of the subcontracting activities, has assumed an executive position with the Smaller War Plants Corporation in Washington. He was granted a leave of absence from the company at the request of the government.

As special assistant to Maury Maverick, chairman and general manager of SWPC, Mr. McCarty will assist in obtaining a share of war production contracts for smaller industries and assist in arranging for financing production costs where necessary.



**R. McCarty**

**W. F. Boyle**

**W. F. Boyle** has been appointed manager of Westinghouse gas turbine activities at the steam division plant at Philadelphia, according to a company announcement. His new duties will cover the development and application of gas turbines to probable use for aircraft, ships, industrial power, and electric power generation. He formerly was manager of the Marine section of

the steam division application department, and prior to that was manager of the division's sub-contracting department.

**Hollis H. Mosher**, has been appointed field division representative for the upper New York State area by Firth-Sterling Steel Co. He formerly was shop master mechanic for Jacobs Aircraft Engine Company, Plant No. 2, at Pottstown, Pennsylvania.

**George H. Clark**, vice president in charge of engineering at Formica Insulation Co. has been named a director of the Society of the Plastics Industry. He is credited with sponsoring an important testing program in a specially operated laboratory at Johns Hopkins University.

**C. E. Parkhurst**, associated with Moline Tool Co. for the past 16 years, has been named chief engineer, according to a company announcement. He succeeds **A. E. Lindberg**, who retired May 1, after 25 years service.

**D. C. Eipper**, a company employee for 25 years, succeeds Mr. Parkhurst as assistant chief engineer.

(Continued on page 218)

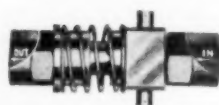
## KEEP MACHINES PRODUCING *for Victory*



Cam operated  
2- and 3-way types



Diaphragm operated  
2- 3- and 4-way types



Mechanically  
operated 2-and  
3-way actions



Lever operated  
2- and 3-way  
actions

Q. A. W. valves are doing valiant service in war work by promoting faster operation and insuring uninterrupted production. They can be easily adapted to most any pressure control situation. They operate

millions of times without loss of efficiency or requiring time out for servicing. Short travel and inherent balance in any position contribute to smooth, lively, easy action. Available in a wide range of types and sizes for practically any application.

Send for catalog and data book.

**C. B. HUNT & SON**

1868 E. PERSHING ST. • SALEM, OHIO

# Quick-As-Wink

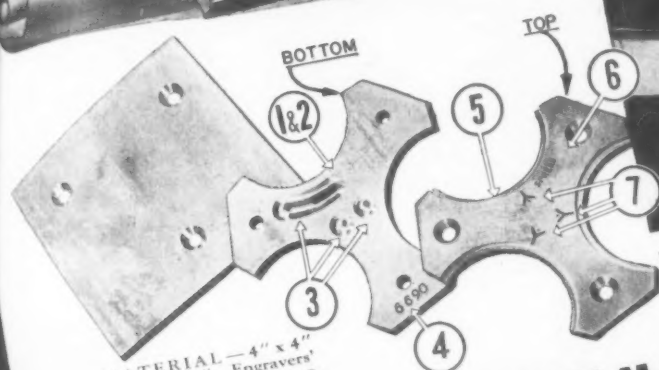
## CONTROL VALVES



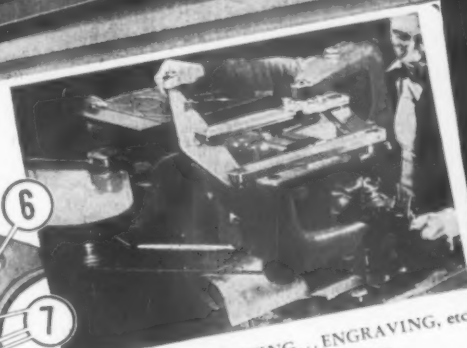
# GORTON

SPECIALISTS FOR OVER 50 YEARS IN

## Tracer-Controlled MILLING



MATERIAL—4" x 4" square,  $\frac{3}{16}$ " Engravers' Brass, as it comes to Gorton Pantograph, with three holes drilled, countersunk.



PROFILING...SLOTING...ENGRAVING, etc. with Unskilled Operator

### Seven Operations on **ONE** Machine...from 1 Master

Showing **VERSATILITY** of GORTON PANTOGRAPH Tracer-Control . . .

**ONE** GORTON 3-Z PANTOGRAPH now performs work of several machines, eliminating various tools and fixtures formerly required—saving time and expense of separate machine set-ups and tooling.

**SIMPLY BY CHANGING CUTTERS AND TRACING** on both sides of a single, Flat Template (Master)—both top and bottom of this intricate part are completed within specified tolerances of  $\pm .0025$ "—a total of 7 operations, in  $\frac{1}{3}$  previous time.

#### JOB IN BRIEF

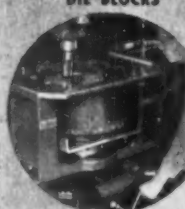
- PART**—Indicator Plate.
- 7 OPERATIONS**—(1) **ROUGH MILL** three arc sections... (2) **FINISH-MILL** sections... (3) **MILL** semi-circular groove and two  $\frac{5}{32}$ " counter-bores... (4) **ENGRAVE** Part Number... (5) **Reverse Master and Part, PROFILE** three U-shaped grooves along arc edges... (6) **ENGRAVE** word "SPREAD" and (7) **ENGRAVE** three Y-SLOTS to penetrate counter-bores.
- CUTTERS**—(only 4 needed)—Single Flute, straight-shank End Mills.
- SPEEDS**—Up to 9,200 r.p.m.

#### ENGINEERING SERVICE . . . FREE

Find out how Gorton Tracer-Control Machines can pay for themselves in time and man-power savings like this in your shop... how they can perform multiple operations, freeing other machines for new work and increase production.

**SUBMIT ANY PROBLEM**—Send a sample part, prints, or specifications to your nearest Gorton dealer, or to the Gorton Factory at Racine, Wis. No obligation.

The Right Size  
The Right Type  
of Machine  
for Every Job . . .  
From 2 oz. to 2 ton  
DIE BLOCKS



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Tracer-Controlled DUPLICATING



Tracer-Controlled ENGRAVING



Tracer-Controlled ETCHING



## GORTON Precision MACHINES



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Send me these free books  
Condensed Catalog  
Pantograph Engraving  
Machine



Name ..... Title .....

Company .....

Address .....

City ..... State .....



**Clifford T. Appleton**, formerly vice president of Leon J. Barrett Co., has been appointed manager of the machine division of the Rolled Thread Die Co. Prior to that time he was associated with Heald Machine Co. and Reed-Prentice Corp.

**R. L. Irvin** has been named by Westinghouse Electric and Manufacturing Co. to be application manager of its small motor division. He formerly was industrial manager of the company's Northwestern district at Chicago.

**Clinton E. Swift**, formerly manager of the welding division of Ampco Metal, Inc., has been appointed assistant manager of the Engineering and Research Department of Eutectic Welding Alloys Co. Prior to his association with Ampco, he was welding engineer for C. F. Braun Co. and was on the engineering staffs of the American Brass Co. and Westinghouse Electric and Manufacturing Co.

**William F. Lamoreaux**, for the past three years director of research for the Meehanite Metal Corp. has been appointed research metallurgist for the Cooper-Bessemer Corp. His new duties will include integration of the company's engineering, metallurgical, and foundry activities.

**Charles E. Sorensen**, eminent automotive production figure who served nearly 40 years with the Ford Motor Co., now is associated with Willys-Over-

land Motors, Inc., as chief executive officer. According to a company announcement, Mr. Sorensen probably will become president of the concern.



C. Sorensen



P. Darling

**Paul E. Darling** has been appointed assistant division manager of the Detroit Pressed Steel Division of the Midland Steel Products Co.

He had been chief engineer for the company for several years before resigning to engage in consulting engineering. His appointment followed his recent return to Midland Steel.

**Paul Doxey**, formerly works manager at Turbo Engineering Company has been named works manager for Service Machine Co. **Ernest Carlson**, formerly chief of machine design at Allen Engineering Co., has been made chief process engineer.

**F. W. Lee**, has been named field engineer for the Philadelphia district by

Norton Company to succeed **A. W. McCune** who has joined the United States Navy. Prior to his present appointment, Mr. Lee had been associated with the research laboratories and engineering service department.

**E. L. Foreman** has been named manager of the recently established Whitman & Barnes branch at Los Angeles. He formerly was manager of the company's New York branch and prior to that was connected with the factory at Detroit. His assistant will be **Lee W. Shetler**.

Also, **B. J. Rohde** will represent the company in San Francisco, Northern California, Utah, and Nevada. **W. H. Dick** will service Oregon, Washington, Montana, and Idaho.

**M. T. Berry** has been named service engineer by Firth-Sterling Steel Co. for the territory covering 22 counties in upper New York State. He formerly was associated with Brown-Lipe-Chapin Co. and Easy Washing Machine Co.

**Thomas J. Kearney**, formerly technical adviser to the director of sales, has been promoted to assistant chief engineer in charge of industrial equipment design and detailing by Detrex Corporation.

**John A. Faler**, formerly assistant chief engineer of the company, has been put in charge of development of extraction equipment.

THE END

In War, as in Peace...

## CERRO ALLOYS

SAVE TIME and CUT COSTS!

**CERROMATRIX** (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

**CERROBEND** (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

**CERROSAFE** (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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BOSTON, MASS., Jackson Associates.  
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DALLAS, TEX., Metal Goods Corporation.  
DETROIT, MICH., Castaloy Metal Sales Company.  
HOUSTON, TEXAS, Metal Goods Corporation.  
KANSAS CITY, MO., Metal Goods Corporation.  
LONDON, ENG., Mining & Chemical Products, Ltd.  
LOS ANGELES, CAL., Castaloy Metal Sales Company.  
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MINNEAPOLIS, MINN., Northern Machinery & Supply Co.  
MOLINE, ILL., Sterling Products Co., Inc.  
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NEW ORLEANS, LA., Metal Goods Corporation.  
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**CERRO DE PASCO COPPER CORPORATION**

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## Wipe Out SPOILAGE LOSSES!

Don't let spoilage losses in tapping and reaming eat up your profits! Oversize and bell-mouthed holes due to misalignment between machine spindle and work will become a thing of the past when you change over to a Ziegler Floating Holder. Try it and see! By automatically compensating for inaccuracies in spindle alignment as high as 1/32", the Ziegler Holder solves the problem of getting perfect results even with inexperienced help, reimbursing you for its cost in a remarkably short time.



**W. M. ZIEGLER TOOL CO.**

1920 Twelfth Street

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CATALOG

*Ziegler*  
ROLLER  
DRIVE

**FLOATING HOLDER**  
for Taps and Reamers...

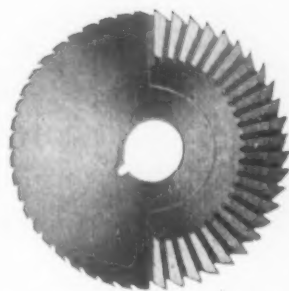
# "TAILORED TOOLS"



Old Style Plain Mill converted into modern Side Mill or Spiral Half-Side Mill.



Old Style Side Mills can be converted into Alternate Tooth, coarse or fine pitch.



Old Style Slitting Saw changed to New Type, with side chip clearance.

**Yes** we convert Standard Tools to *special* or to your specifications. We have been extremely busy, producing in great volume, "Tailored" High Speed Tools to special for the highest precision standards of war production.

The great tradition of Quality Service is one of the most important adjuncts of our business. The other important factor is the great savings effected in recutting worn Cutters, Drills, Reamers, End Mills, and other High Speed Tools, and also in reclaiming worn-out tools taken from scrap stock piles.

These services conserve essential steel, which helps greatly to maintain consistent production, thereby increasing profits by reducing excessive tool costs.

● Tool cost can be cut 50%, and delivery expedited to a matter of days instead of months.



● Why not call on us to give you some of our 30 years of tool experience. There is no obligation.

## A COMPLETE RECONDITIONING SERVICE FOR TOOLS

NEW MILLING CUTTERS FROM OUR STOCK OR YOUR OWN STANDARD CUTTERS CAN BE QUICKLY CONVERTED TO SPECIAL CUTTERS



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Chrome Plant **MASTER CHROME SERVICE INC.**, 5709 Herman Ave., N. W., Cleveland, Ohio



## GRAND *Speed* CLAMPS

**QUICKET ... for  
Faster Production  
— Tighter Holding**

Can be set in 4 seconds and released instantly. Ratchet set with side screw powerful fulcrum leverage tightening. 1-hand operation with absolutely non-creeping grip even on irregular surfaces. Setting the pace in war production everywhere.

Ask also about our complete line of Alloy-Steel "C" Clamps with *even greater than* forged clamp capacities, but cost less. Opening sizes up to 18" and proof test capacities up to 19,000 lbs.

Send for new 32-page Catalog

**GRAND SPECIALTIES COMPANY**

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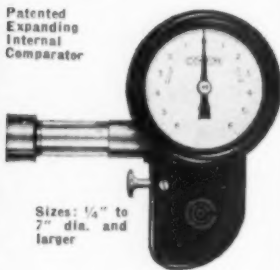
Chicago 22, Ill.

"I gage air-  
plane parts  
to a fraction  
of one ten-  
thousandth"



Precision internal gaging  
is routinized by  
**COMTORPLUG**

Patented  
Expanding  
Internal  
Comparator



Sizes: 1/4" to  
7" dia. and  
larger

Through a unique combination of features, Comtorplug provides a highly accurate internal gage equally satisfactory for use by machine operators, bench inspectors, final inspectors, not excluding trainees. To a fraction of .0001", it shows size, out-of-round, front or back taper, bell mouth, etc., in exact figures (not a passing reading). Gets to bottom of shoulders and blind holes.

Request Bulletin 29

**THE COMTOR CO.**

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**PRICE \$67.50**

FOR COMPLETE SET OF 36 BLANKS  
AND 7 HANDLES IN CASE

The NEW Atlantic Emergency Set contains 36 cylindrical plug gage blanks in steps of 1/16" with handles, which will enable you to make any size plug gage from .029" to 1.010" in just a few minutes work on a cylindrical grinding machine. Our blanks are oil hardened throughout, shank finish ground and centers on both ends are lapped. Thus only the O.D. must be finished by grinding when gages of commercial finish are required and by lapping for gages of higher standards.

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*Specify* **HILCO**  
HYFLOW OIL FILTERS



**HILCO** Hyflow Oil Filters are used for filtering all types of industrial oils such as used for cutting and lubricating. Units are available for stationary use or portable operation for moving from one machine tool to another.

By keeping cutting and lubricating oils in good condition, oils are kept in service for an indefinite time and result in less down time, longer periods between tool grindings and better finished work. This means increased production.



Write today for free literature and see what Hilco operators are doing — then let us help you select a Hilco to take care of "That Particular Job."

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Load capacity  
200 to 40,000 lbs.  
at 100 rpm

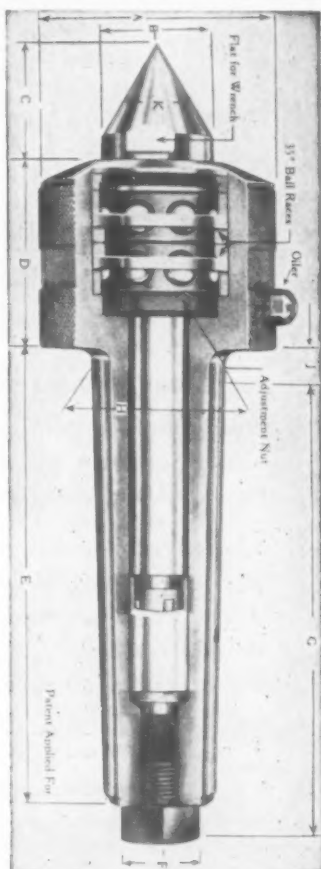
Have adjustment  
to take up wear  
and  
preload bearings

★  
Standard Morse  
Taper No. 2 to 6  
in stock

★  
WRITE FOR  
CATALOG

**NIELSEN**  
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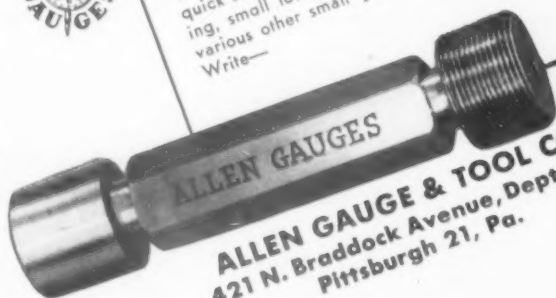


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**Precision Ground  
THREAD, PLUG  
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RING GAUGES  
PROVE YOUR PRODUCT!**

With ALLEN GAUGES of all types—pro-  
file — length — flat — flush pin — snap  
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Also prompt delivery on special gauges  
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quick service on production thread grind-  
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*Darwin*

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COBALTCROM**

**Air Hardening, Non-Deforming,  
Cobalt High-Carbon, High Chromium Steel**

In your change-over and re-tooling opera-  
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Cobaltcrom. This alloy tool steel is the  
ideal material for extended runs and better  
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We can ship forged discs and ring forgings promptly.

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*highest grade tool steels*  
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40 years doing one thing  
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## Accuracy lasts longer with new J-83 Gage Block Set!



**T**WO wear blocks of tough tungsten carbide protect the surfaces of the 81 alloy steel blocks. That's why the Jansson J-83 set of precision gage blocks stays accurate longer. Makes 120,000 gages in steps of .0001" from .200" to over 12". Skilled Jansson workmanship assures accuracy to .000008", .000004", or .000002".

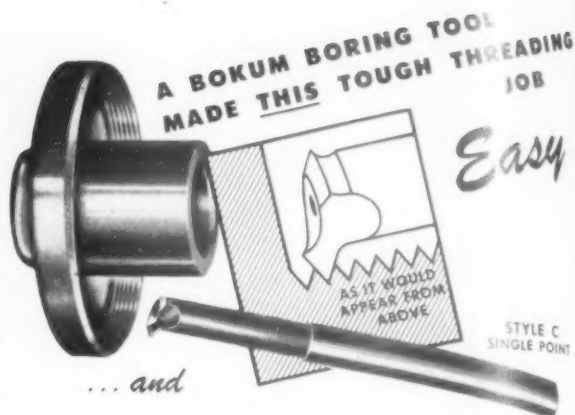
Write for free copy of Jansson's 60-page "Handbook of Precision Measurement." Enthusiastically praised from coast-to-coast. For precision gage blocks, calipers, height gages, sine bars, tri-square, and special gages see Jansson, "The House of Precision", first.



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## IT WILL MAKE YOUR THREADING JOB EASY

Shank of tool is lined up parallel with line of centers. Bisecting line of thread is always at right angles to machine axis.

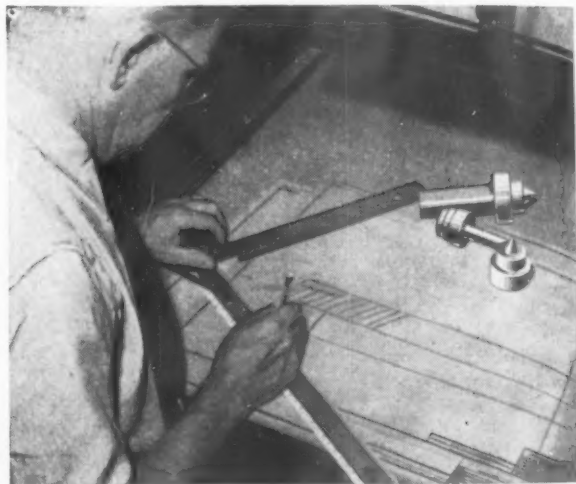
In blind holes, threads can reach clear to bottom—no other tool like it. Easy to use. Reconditioning does not change ground thread form (tool is resharpened on top surface only). Results: accuracy and long life.

For super High Speed Tools, ask for Catalog A-1139 and for Carbide Tipped A-398.



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A properly designed Live Center is one of the fundamentals of setting up a job and requires a specialist's experience. Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action that compensates for expansion due to heat shock and excessive thrust loads—reducing wear to a minimum. Send us your blueprints and specifications — we will see that your job gets set up with the right Live Center. Standard shanks with Morse taper carried in stock.

**STURDIMATIC**

**TOOL COMPANY**  
5218 Third Avenue  
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**LIVE CENTER**

THE TOOL ENGINEER



**"WE'VE  
DOUBLED  
OUR INSPECTION SPEED"**  
—says  
**BUFFALO ARMS**

Priced  
from  
\$9.75 up

Fifty MICRO-CHEK Production gages have greatly speeded inspections of a multiplicity of machine gun parts at the efficient plant of the

Buffalo Arms Corporation. The speed of some inspections has been doubled over that of former gages.

Would you like to know more about the time-saving, cost-reduction record of this modern, versatile gage which now is in use in more than 3500 war plants and government arsenals? Send for our booklet.

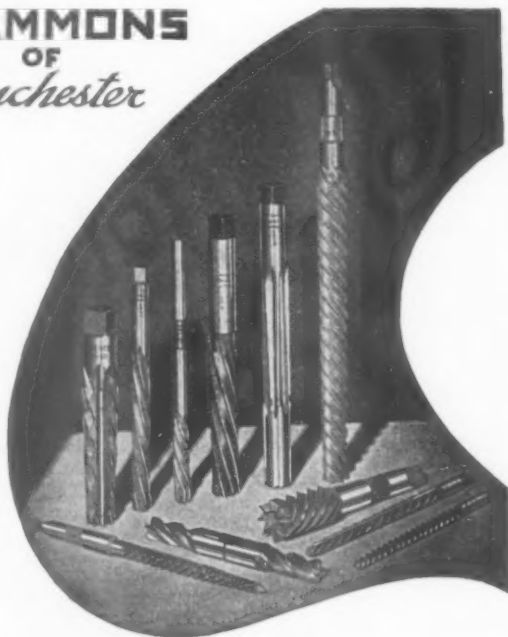
**TRICO**

**MICRO-CHEK**

TRICO PRODUCTS CORP.

5 Trico Square, Buffalo 3, N. Y.

**GAMMONS  
OF  
Manchester**



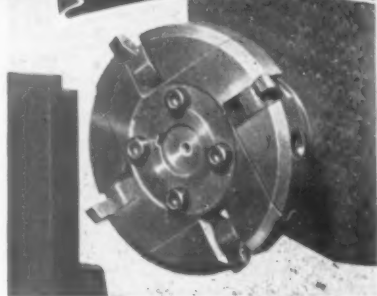
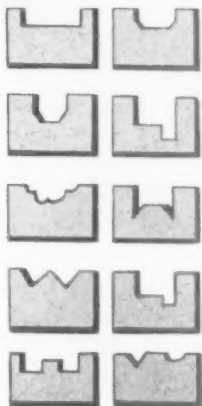
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ORIGINATORS AND  
MANUFACTURERS OF HELICAL  
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THE GAMMONS-HOAGLUND CO., MANCHESTER, CONN.

JULY, 1944

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**STANDARD BITS MAKE 4 TO 6  
DIFFERENT CUTS IN 1 OPERATION!**

For many types of milling, light metals and plastics as well as steel, there is no longer need for special cutters. A single Newfield Universal Fly Cutter, utilizing any type of standard high speed steel or carbide bits, makes multiple cuts in one operation. In contrast with expensive specially ground cutters, the standard bits used in the Newfield are easily and quickly ground in your own shop, readily replaced or reground for other work, at small cost. There is practically no down-time if a bit is broken.

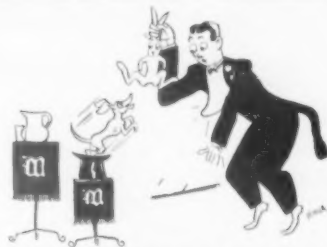
The Newfield fits all standard arbors, turns to any required speed for fly cutting, slotting, surface and straddle milling, gear cutting, disc and gasket cutting. Standard sizes are 4", 6", 8", 10". Write for details of this versatile, production-upping, money-saving tool.

*Above—a few of the many cuts that can be made with the Newfield Universal Fly Cutter in ONE operation on a horizontal or vertical mill or drill press. Individually adjustable bit holders permit slots of any shape to be cut 3/16" to 1-1/2" wide.*

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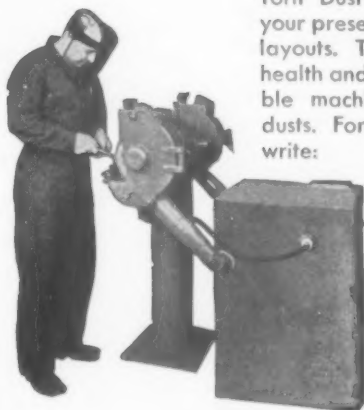
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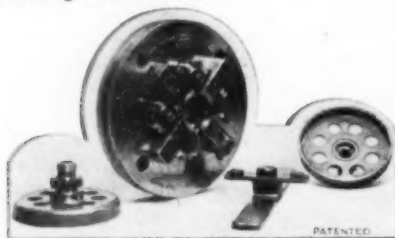
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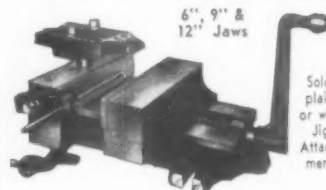
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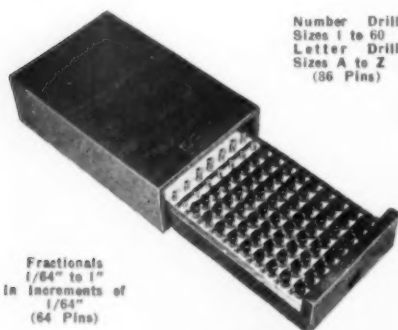


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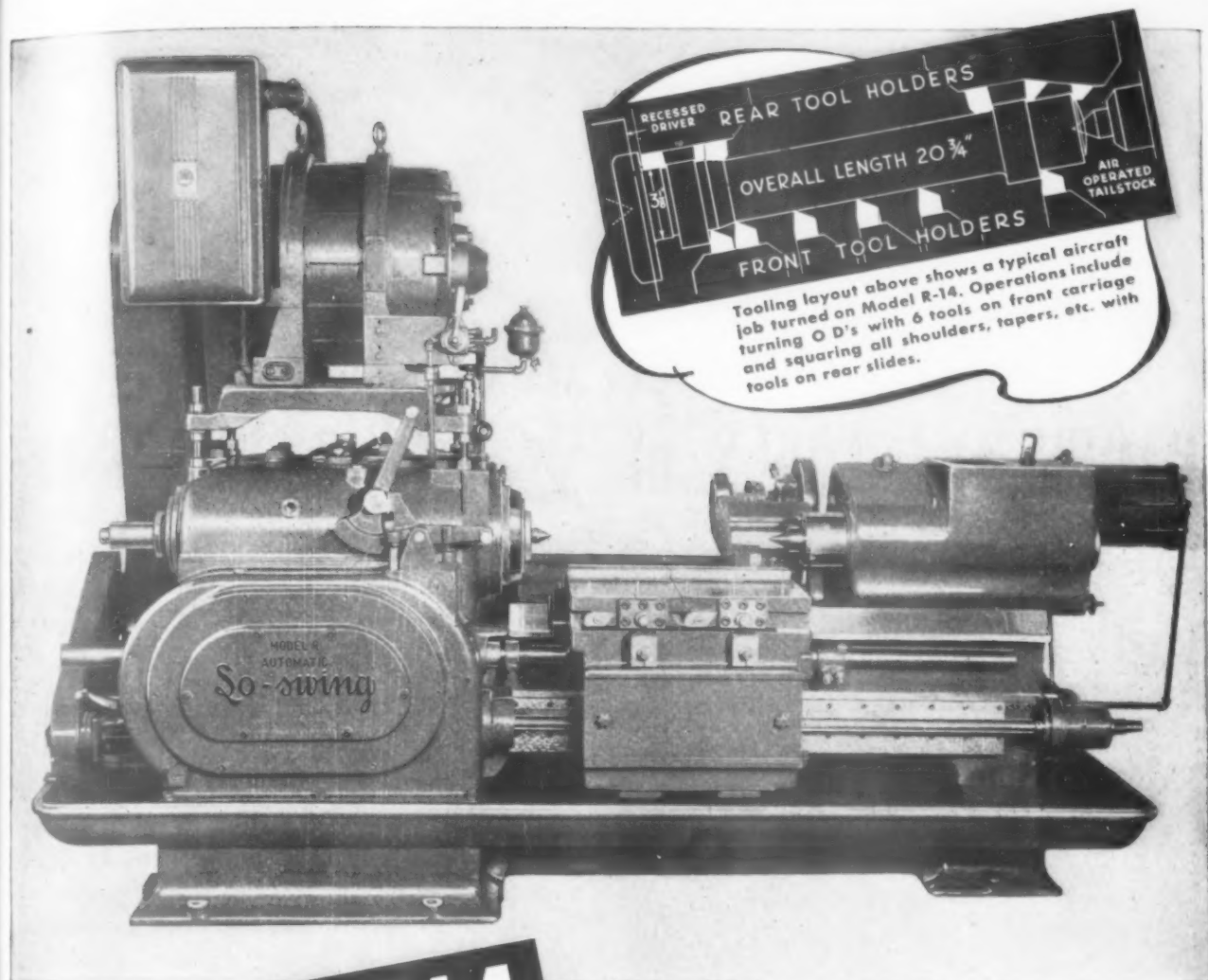
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# MODEL R14

## MAKING HISTORY ON AIRCRAFT PRODUCTION

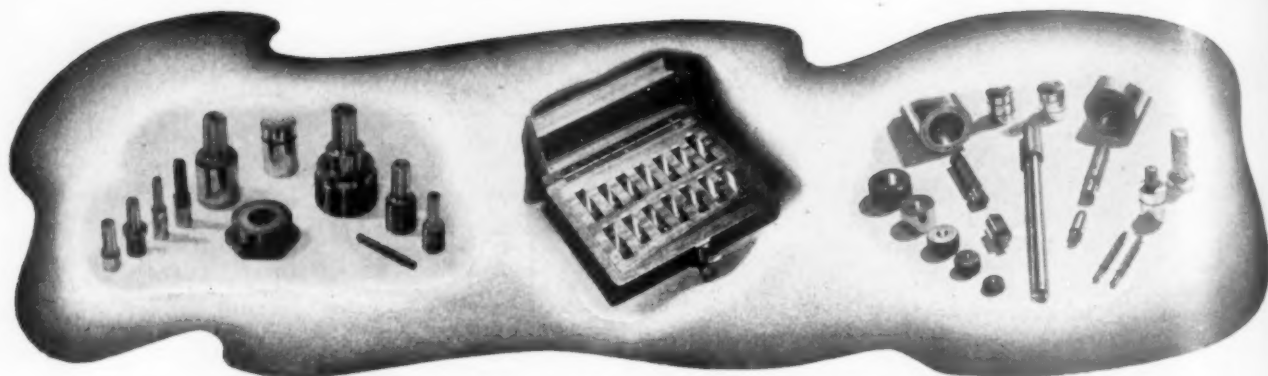
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